(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 397 019 A2

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
**10.03.2004 Bulletin 2004/11**

(51) Int Cl.$^{7}$: **H04Q 11/04**

(21) Application number: **03022623.7**

(22) Date of filing: **23.06.1999**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE**
Designated Extension States:
**AL LT LV MK RO SI**

(30) Priority: **24.06.1998 US 90443 P**

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
**99930625.1 / 1 090 529**

(71) Applicant: **Research Investment Network, Inc**
**Irvine, CA 92614 (US)**

(72) Inventor: **Lee, Kenny Ying Theeng**
**Duluth, GA 30097 (US)**

(74) Representative: **Kuhnen & Wacker**
**Patentanwaltsgesellschaft dbR**
**Postfach 19 64**
**85319 Freising (DE)**

Remarks:
This application was filed on 06 - 10 - 2003 as a divisional application to the application mentioned under INID code 62.

# (54) Method and system for handling a loop back connection using a priority unspecified bit rate in ADSL interface

(57) An asynchronous transfer mode system, comprising a connection to an asynchronous transfer mode network, sending information in a specified asynchronous transfer mode format and receiving messages in said specified asynchronous transfer mode format, said messages including cells of information with specified qualities of service, said specified qualities of service including a constant bit rate service, an unspecified bit rate service, and a priority unspecified bit rate service.

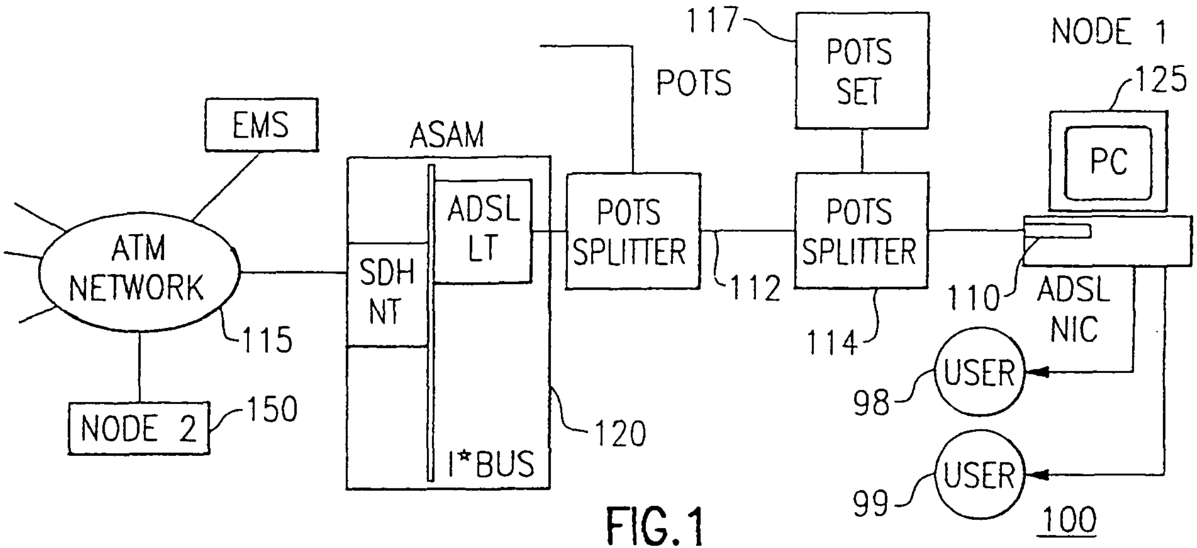


FIG.1

Printed by Jouve, 75001 PARIS (FR)

## Description

Cross Reference To Related Applications

**[0001]** This application claims the benefit of U.S. Provisional Application No. 60/090,443, filed June 24, 1998.

Field

**[0002]** The present system teaches a new priority system for asynchronous transfer mode, and an application of that new system to a loop back operation.

Background

**[0003]** Asynchronous transfer mode or ATM is a telecommunications protocol that allows packet based transfer of information. Cells of information are sent across an information network defined by a number of nodes. The information is sent from node-to-node.

**[0004]** An ATM transport network (i.e., a communication network which transmits information using ATM cell packets) is known to include an ATM layer and a physical layer. The ATM layer is based on the virtual path/virtual channel (VP/VC) concept. The VC identifies a unidirectional communication capability through which ATM cells are transported. One or more virtual channels (VCs) can be used in a particular virtual path (VP), which also identifies another level of the communication capability through which the ATM cells are transported.

**[0005]** An ATM cell is the smallest information unit. It includes a header field of 5 bytes or octets, and a payload field of 48 bytes or octets. The header field includes VP and VC identifiers. These identifiers are used for routing the information to an intended destination).

**[0006]** Communication in known ATM networks is initiated during a connection setup, after which cells belonging to one connection follow a predetermined path defined by the VPI and VCI on a particular link. The connection control information transferred during setup utilizes a unique Signaling VC (SVC) which is included in the VP. The SVC is identified by the virtual path ID (VPI) and virtual channel ID (VCI).

**[0007]** Cells destined for many different end points are sent over a single physical communications circuit. The header of each cell includes a channel identifier which is used to control the routing of the cell through the ATM system. The channel identifier determines routing of the cell.

**[0008]** In a typical ATM system there are 256 possible VPIs and 65,536 possible VCIs; thus, there are 16,777,216 possible channel identifiers (VPI/VCIs). One of the many challenges in designing an ATM network is how to handle this huge number of connections.

**[0009]** Specified traffic control protocols are used to determine the routing of the information. The routing is controlled using conventional addressing techniques.

**[0010]** Further details of ATM are well known in the art. In addition, different flavors and sub-types of ATM are known, including digital subscriber line ("DSL"), asymmetric digital subscriber line("ADSL"), and other flavors of digital subscriber line ("XDSL").

**[0011]** In all of these communication modes, a message is broken into multiple portions or cells. A conventional ATM system breaks the total message to be sent over ATM into 48 byte data portions. A typical data message might be, for example, 1500 bytes in length. Hence, the 1500 byte message is divided up into 31 of the 48 byte cells.

**[0012]** Specified traffic control protocols are used to determine the routing of the information. The routing is controlled using conventional addressing techniques.

**[0013]** ATM has the ability to provide a guaranteed quality of service. This compares with other information services which have no such guarantee. Data packages are subdivided into classes of services. The ATM switches prioritize each data packet routing based on the quality of service.

**[0014]** Conventional quality of service classes include constant bit rate ("CBR"), variable bit rate ("VBR") and unspecified bit rate ("UBR"). These classes are based on ITU recommendation 1.371 entitled Traffic Control, congestion control in BSIDN and on version 4.0 of "the Traffic Management specification". Connection data transmission rates may be set on a semi-permanent basis depending the requirements for the connection.

**[0015]** One very good quality of service is CBR or constant bit rate. The data is guaranteed to arrive at a constant rate. The ATM switches along the virtual path prioritize the data packages. The CBR traffic gets priority over the remaining traffic. Therefore, even if there is one or more congested switches, the CBR still gets through quickly.

**[0016]** UBR, or unspecified bit rate is at the other end of the scale as compared with CBR. There is no guarantee about when the data will arrive at the destination.

**[0017]** Other classes of service have been defined by the ATM forum. However, these can require extensive and complicated handling by the ATM switch. Examples include AVR (available variable rate) or VVR (variable variable rate). Each requires that the ATM switch be significantly reconfigured to handle the new requirements.

**[0018]** A IEEE publication by Bromirski et al. dated 6/97 entitled "Prioritized state-dependent buffer-management schemes in ATM switch" discusses a buffer management scheme using two different service disciplines to improve the quality of service among different traffic classes. In summary, it prioritizes the transmission of the CBR and UBR data through use of individual buffers for CBR data and UBR data. There is one pointer in each buffer for the latest arrived CBR and UBR cell. When the buffers become full, the pointer are equal, and the CBR data gets discarded while the UBR data is stored.

**[0019]** European Patent Application EP 0 843 499 A2 (Italtel S.P.A.) discloses a method and device for the management of resources in ATM technique for weighted fair queuing (WFQ) applications. The reference discloses use of a CBR data queue and separate queues for differing UBR data.

**[0020]** U.S. Patent No. 5,748,629 teaches an ATM network switch and method of utilization for adaptively providing integrated services through use of allocated and dynamic bandwidth management. The reference discloses use of separate buffers for each separate class of service, wherein each buffer employs FIFO (first-in, first-out) data priority.

**[0021]** WO 98 06203A (Advanced Telecommunications Modules, Ltd.) discloses a method and apparatus for source rate pacing in an ATM network. The method prioritizes between data in the various class of service (CoS) such as CBR, real-time VBR, non-real time VBR, ABR and UBR data and transmits CBR and real-time VBR data cells first via static scheduling. The remaining CoS data cells are sent to a separate ("latent") queue for transmission based on dynamic scheduling. This dynamic scheduling essentially employs a FIFO method of prioritizing between non-real time VBR, ABR and UBR data cells within the latent queue, without the capability to further prioritize the different Cos' within the latent queue.

**[0022]** U.S. Patent No. 5,754,530 discloses a method for flow control of ABR traffic in ATM networks, wherein traffic rate data within the system is generated, and resource management cells are used to provide traffic rate feedback. The traffic rate feedback is used to control and adjust traffic flow within the system.

## Summary

**[0023]** The present specification defines another quality of service class for such a communication connection. The present system uses the relatively simple interface of CBR/UBR to provide an intermediate form of service using the same memory infrastructure as in CBR/UBR. In particular, the present system defines a class of service that accommodates loop back within an ATM network. This intermediate form of service enables an unspecified bit rate which can provide protection against backlog in a congested switch, without giving of priority over all other parts.

## Brief Description of the Drawings

**[0024]** These and other aspect will now be described in detail with respect to the accompanying drawings, wherein:

FIG. 1 shows a general network architecture of the present system;
FIG. 2 shows the timing ring, as well as the transmit buffer associated with the timing ring;
FIG. 3 shows a flowchart of operation to handle different priority information;
FIG. 4 shows a block diagram of the network interface card preferably used according to the present system;
FIG. 5 shows a block diagram showing the clocking of the present system;
FIG. 6 shows a flowchart of the different power-up modes;
FIG. 7 shows different user selectable operations;
FIG. 8 shows the reset flowchart;
FIG. 9 shows dying gasp used during reset;
FIG. 10 shows a power supply layout;
FIG. 11 shows a block diagram of the application specific integrated circuit (ASIC) which can be used;
FIG. 12 shows a network interface diagram with components;
FIG. 13 shows a flowchart showing some aspects of installation;
FIG. 14 shows a network interface diagram;
FIG. 15 shows a screen shot of windows autodetection;
FIG. 16 shows a windows NP installation;
FIG. 17 shows a flowchart of different operations of installation;
FIG. 18 shows a screen shot of application parameters;
FIG. 19 shows a service monitor screen shot;
FIG. 20 shows a service connection screen shot;
FIG. 21 shows a network connection screen shot;
FIG. 22 shows the modified network configuration dialog;

FIG. 23 shows connecting using asynchronous transfer mode over ATM connection dialog;
FIG. 24 shows the setup of global ATM;
FIG. 25 shows the setup of network performance for global ATM;
FIG. 26 shows the optionally configuration parameters tab for ATM;
FIG. 27 shows a download flowchart;
FIG. 28 shows a preferred data structure used for the download flowchart;
FIG. 29 shows a basic block diagram of the ADSL NIC firmware;
FIG. 30 shows a first diagram of mailboxes used to communicate the PCI bus and the controller;
FIG. 31 shows a second block diagram using only part of the mailboxes;
FIG. 32 shows a flowchart of operation of the mailboxes;
FIGs. 33-46 show ADSL open command flows;
FIG. 47 shows a basic installation process;
FIG. 48 shows the flow diagram for installing new services;
FIG. 49 shows a flow of power-up;
FIG. 50 shows the loading operations occurring on power-up;
FIG. 51 shows a memory map of the hydrogen chip sets;
FIG. 52 shows another flowchart of power-up;
FIG. 53 shows mailbox operations with a hydrogen chip set;
FIG. 54 shows connecting to the hydrogen; and
FIG. 55 shows direct memory access to the hydrogen.

Description of the Preferred Embodiments

**[0025]** The disclosed mode as described with reference to Figures 1-3 describes a switch architecture and includes a new quality of service for use in an ATM network. This new quality of service is called priority unspecified bit rate or priority UBR. This new priority UBR class also enables a testing mode that gives a more accurate test of the network, using a loop back condition that gauges the message handling capability of a UBR system.

**[0026]** The overall block diagram of the general network architecture is shown in FIG. 1. The embodiments described herein can operate as part of an ATM system. An ADSL interface card for communicating with an ADSL network is described. More generally, however, this system can operate within any system that carries out data communication by dividing a total message into separate addressed packets, or more specifically in an asynchronous transfer mode system.

**[0027]** A PC 125 is, for example, an Internet service provider that provides Internet service to a number of users 98, 99, and others that are not shown. PC 125 includes an ADSL network interface card or "NIC" 110. NIC 110 connects to the telephone line 112 via a plain old telephone system (POTS) splitter 114. Other POTS equipment 117 can include conventional telephone equipment.

**[0028]** A conventional ATM subscriber access multiplexer or "ASAM" 120 connects from telephone line 112 to ATM network 115. The ASAM 120 multiplexes a number of communications via the ATM network 115. In this system, the NIC 110 becomes a node connecting to the ATM network 115 which allows routing to other nodes, such as second node 150. While only one second node 150 is shown, the ATM network is typically connected to literally thousands of other nodes shown generally in FIG. 1. Any of the multiple nodes can send or receive a message. The connection among these nodes are based on their VCI/VPI identifiers.

**[0029]** Node 1 receives a number of cells that will form ATM messages.

**[0030]** The ADSL NIC 110 forms a node on the network. This node, like other nodes, is capable of handling connections that include CBR and UBR data within a timing slot ring. The timing slot ring could alternatively be physically located elsewhere in the network.

**[0031]** Figure 2 shows the timing slot ring that is used to hold data to be sent or information indicative thereof. The timing slot ring 200 can be stored in NIC 110 or in memory associated with a processor. This can be in the NIC 110 or in PC 125 or in any node or switch. The timing slot ring 200 is assembled to have data in an order that enables it to be sent at a desired time. The timing slot ring 200 is investigated at each time slot. Data is transmitted at that time slot according to its priority.

**[0032]** Each timing slot can have CBR data and/or UBR data as shown. If UBR data is present in a time slot, the UBR data is copied to a UBR queue 212, as shown. UBR queue 212 is a buffer or an array used for transmitting UBR data from timing ring slot 200. The procedure for copying UBR data from timing ring slot 200 into UBR queue 212 and transmitting it therefrom is discussed below with reference to FIG. 3. If CBR data is present in a time slot, either exclusively or in conjunction with UBR data, the CBR data is transmitted immediately from timing slot ring 200. UBR queue 212 has a first pointer (In_ptr) 214 to indicate the location in which UBR data is to be stored in the buffer and a second pointer (out_ptr) 216 to indicate the location in the buffer which data is to be transmitted from. Those skilled in the art will appreciate that for a more efficient use of UBR queue 212, a pointer to the address of the UBR data within timing slot ring 200 may be copied to UBR queue 212, instead of copying the UBR data packet itself into UBR queue 212. This will minimize the size of the buffer required for UBR queue 212.

**[0033]** According to the present system, a special flag is added to certain UBR timing slots 210. This flag provides those items of UBR data with priority within the UBR timing slot ring 200. This flagged data becomes "priority UBR".

**[0034]** Priority UBR data is placed in a location where it will be transmitted before the non-priority UBR data. In this embodiment, it is copied to the front 218 of the UBR queue 212, instead of being added to the back 220 of the UBR queue 212 as is done for normal UBR data.

**[0035]** In essence, the priority UBR data will always be handled before conventional UBR data but still after CBR data. Importantly, however, this creates a new class of service using the existing timing slot ring structure that is already used for CBR/UBR.

**[0036]** One application of this new class is for allowing certain network testing. A specific loop back connection is described for testing purposes, for example.

**[0037]** Figure 3 shows a flowchart of the operation to handle different priority information. This flowchart can be carried out in software, hardware defined by hardware definition language (HDL), firmware, or combinations thereof. This is most advantageously carried out within the modem software of the ADSL NIC 110.

**[0038]** The operation starts at step 405 where the system first determines whether the current data is UBR data. If the data is UBR data, flow proceeds to step 410 which determines if the data is regular UBR data or priority UBR data. The two classes are handled differently, as described above.

**[0039]** If the data is P-UBR, step 415 represents the procedure for sending the data or its address to UBR queue 212. Out_Ptr 216 is decremented by moving towards the front 218 of UBR queue 212. The P-UBR data or its address is then assigned to the address of Out_Ptr 216. If at step 410 it is determined that the data is UBR data, setp 420 represents the procedure for sending the UBR data or its address to UBR queue 212. In this instance, the UBR data or its address is assigned to the address of In_ptr 214. In_ptr 214 is then incremented toward the back 220 of UBR queue 212.

**[0040]** If at step 405 there is no UBR data detected, the flow proceeds to step 425 which detects whether there is CBR data in timing ring slot 200. A positive detection of CBR data in the timing ring slot 200 causes that CBR data to be transmitted at step 435.

**[0041]** If there is no CBR data in the timing ring slot 200, (or after all the CBR data has been sent) the flow proceeds to step 430 which transmits the output data located at the address of Out_ptr 216. Out_ptr 216 is then incremented towards the back 220 of UBR queue 212 to transmit the next UBR data packet in the sequence. It can therefore be seen that when In_ptr 214 is greater than Out_ptr 216, namely positioned further toward the back 220 of UBR queue 212, it is an indication that there is data to be transmitted.

**[0042]** In this way, using the existing memory structure and data structure, an additional class of information can be processed. This class of information is handled after the constant bit rate data, but is not left at the end of the queue where it can be seriously delayed by a congested switch. Rather, this becomes the first UBR data to be sent.

**[0043]** One application of this format is in loop back. A node, such as node 125, may request to test characteristics of the system. The test can be carried out by sending a message to a specified location, along with a command that some response be sent back. This is conventionally called loop back. The amount of time it takes for a message to come back gauges the speed of the system. The mere fact that a message returns indicates that the system is at least working correctly.

**[0044]** However, a very congested switch can skew the response. For example, one congested switch could hold the UBR data for an inordinate amount of time, especially if there is a lot of CBR data at that same switch.

**[0045]** According to this system, a loop back command is sent with an indication that it is priority UBR data. Hence, this loop back command is handled before any of the UBR data. However, this command does not interfere with the CBR data. In addition, since this command does not interfere with the CBR data, it further gives a more realistic view of a network's loading. If CBR data is taking a long time, the priority UBR data will also take a long time. However, a highly congested switch will not skew the values, since this priority UBR data will pass that highly congested switch as fast as any UBR data could so pass it.

**[0046]** The present system describes the ring being stored within a memory associated with a processor. This shows the timing slot ring being formed of two side by side queues. Of course, a single queue could be used. In this case CBR data is put at the front of one queue and UBR data is put at the end of the same queue. The priority UBR data is placed in the middle.

**[0047]** Similarly, in place of two ques, a third queue could be defined, one for CBR, one for UBR and one for priority UBR.

**[0048]** The disclosed embodiment uses an internal PC printed circuit card in the PCI form factor. A block diagram of the board is shown in Figure 4. The board includes, inter alia, an On Board Controller 400 ("OBC") that can include a processor, an FPGA/ASIC assembly 410, an SAR "Hydrogen" chip set 420, power supply 430, and PCI bus connector

440. The assembly runs Modem initialization, Power on Self Test (POST), performance monitoring, and control interface routines among others.

**[0049]** The Hydrogen 420 includes firmware that runs download software, control information passing, and POST initiation.

**[0050]** The ADSL NIC-ATM conforms to all physical requirements for a full size PCI bus card. Throughout this document, all references to the PCI bus are as defined in the PCI Local Bus Specification, Revision 2.1.

**[0051]** The ADSL NIC-ATM has the following dimensions:

| | |
|---|---|
| Length | 12.283" +/- 0.005" |
| Height | 4.2" +/0 0.05" |
| Assy. thickness | < 0.745" |
| PCB thickness | 0.062" +/- 0.008" |
| Comp. height (comp.side) | <0.57" |
| Comp. height (back side) | <0.105" |

**[0052]** The ADSL NIC-ATM PCB edge connector is configured as a 32 bit, 5 volt PCI bus interface card. An external interface is through an RJ-14 PCB mount connector using pins 2 and 5. This connector is accessed through a card edge mounting plate mounted on the PCB. An optional RJ-45 connector can be provided as a "stuffing" option, i.e. an option that can be added on to the basic structure.

**[0053]** At least one red/green bi-color LED 399 is mounted on the PCB in a location to be visible through the card edge mounting plate.

**[0054]** Clock distribution on the board requires multiple domains. The different clocks and their formation are illustrated in FIG.5. This includes Clock domains that exist on the Hydrogen IC, the PCI clock domain and the ARM 400 clock also have their own domains.

**[0055]** The Hydrogen chip takes the PCI 33 MHZ clock 502 from the PCI bus edge connector 440 to the Hydrogen IC 420. The Hydrogen IC is placed to minimize the distance of this clock routing.

**[0056]** The Hydrogen 420 operates at 32 MHZ internally. This 32 MHZ clock 505 is derived from a 8 MHZ oscillator 504 connected to an external 8 MHZ crystal 502. The 8 MHZ crystal is placed to minimize the oscillator input and output trace lengths. Each side of the crystal is coupled to ground through 12 pF caps 510, 512. A 1 M ohm shunt resistor 514 across the crystal is also provided.

**[0057]** The 32 MHZ clock 505 is also output from the Hydrogen IC to the ASIC 410. This output is active whenever the 8 MHZ oscillator is operating.

**[0058]** A 16 MHZ "expansion bus" clock 515 is output from the Hydrogen IC to the ASIC. The ASIC is positioned to minimize the trace length of this clock signal. The bus clock is active whenever the system clock is operating.

**[0059]** The ASIC generates Utopia TXCLK 516 and RXCLK 517 signals and derived from the Expansion Bus Clock. These clock signals operate at 16 MHZ and are present whenever the Expansion Bus Clock is operating. The 16 MHZ operating frequency is within specified operating parameters of both the SACHEM (25 MHZ) and Hydrogen (33 MHZ) Utopia interfaces.

**[0060]** The TXCLK is routed from the ASIC through a level shift buffer 520 to minimize skew between TXCLK and TXD[0:7] when the Txdata is received at the SACHEM Utopia interface.

**[0061]** The level shift buffer can be part of the ASIC 410.

**[0062]** The OBC clock 526 is generated using an on board 25 MHZ oscillator 525. The oscillator is positioned near the OBC to minimize the length of this clock routing. The oscillator operates whenever power is applied to the board. This clock is also routed to the ASIC 410 for distribution/level shift to the SACHEM OBC interface.

**[0063]** The ADSL-C clock 530 is derived using an on board crystal driver/receiver 535. A 35.328 MHZ/crystal 534 is placed on the board to minimize the length of these signal traces. The external circuit to provide VXCO control is implemented as specified by Alcatel.

**[0064]** The Master Clock output from the ADSL-C 450 is routed to the SACHEM IC 460.

**[0065]** The Master Sachem Clock is received from the ADSL-C. Routing distance for this signal is also minimized.

**[0066]** The PCLK input is routed from the ASIC at the processor clock frequency.

**[0067]** The DUART clock is generated using an on board oscillator and an external 1.8432 MHZ Crystal 540. The crystal is placed to minimize the oscillator input and output trace lengths. Each side of the crystal is coupled to ground through a 12 pF cap. A 1 M ohm shunt resistor across the crystal is provided.

**[0068]** Initialization of the modem can be carried out on power up or on reset.

**[0069]** The power up routine is shown in Figure 6. Normal and standalone modes of power up are supported. The mode is controlled by jumper selection of the state of the standalone pin 411 of the ASIC.

**[0070]** The operation of power up proceeds as shown in the flowchart of FIG.6. Step 600 first determines the state of the jumper 411. If the jumper is off, normal power up is started at 602. When power is applied to the board, the Hydrogen IC, ASIC, OBC, and modem components are held in a reset state at 602. PCI bus configuration is performed at 604 by loading PCI configuration parameters from the serial boot PROM 412.

**[0071]** After PCI bus configuration is complete, the Hydrogen run time software is downloaded via the PCI bus 440, to the onboard PCI bus boot ROM 422 at 606. A number of user-defined configuration options are allowed, and are set via the user interface. One such option is the Hydrogen self test. Some of these options are shown in Figure 7. Upon completion of this download at 600, the Hydrogen IC is released from reset, and executes a series of self test functions at 608 if Hydrogen self test is selected at 702. Upon completion of these tests, the Hydrogen 420 downloads the run time software image to the OBC DRAM 402, at 610, from the Host. After completion of this download, the Hydrogen 420 sends a command to the ASIC 410 to the OBC 400 to release from reset at 612. The OBC then executes optional self test functions if selected. The OBC performs modem initialization and setup at 614.

**[0072]** After completion of all self test and setup functions, both the Hydrogen and OBC are operational.

**[0073]** If the jumper 411 is detected as being on at 600, standalone power up mode is selected. This mode is used, for example, for testing and development. In this mode, power is applied to the board, causing the hydrogen 420 to operate. The standalone routine executes PCI configuration at 622, followed by download of code at 624. Optional self test functions and hydrogen initialization are carried out at 626. After completion, normal execution is carried out.

**[0074]** The OBC starts in standalone mode by bootstrapping from flash 404 at 628. Optional self test functions are carried out at 630, and OBC initialization and modem setup at 632, followed by normal execution.

**[0075]** Two modes of reset are also supported and controlled by jumper selection of the state of the standalone jumper 411 of the ASIC 410. If a failure is detected by the host software during reset, the host software informs the user of the suspected failure via the user interface.

**[0076]** The reset flowchart is shown in FIG. 8. If the jumper is off at 800, normal reset is declared.

**[0077]** A reset can be initiated from the PCI bus by assertion of the RESET# line detected at 800. The reset from PCI can only be alone after the assembly has been configured and is operational, with operating power still available to the assembly. If the dying gasp interrupt has been enabled for the assembly (at 706), a dying gasp message is transmitted at 804 before implementing the reset function. The dying gasp signal is a signal that is sent from the modem to applications and/or services that are communicating with the modem. The signal tells these services that the modem is about to be reset. Then, a power up (starting step 602) is called executing the power up instructions 602-614.

**[0078]** A "soft" reset can be initiated via a command from the Host detected at 810. Soft reset first carries out hydrogen bootstrap at 812. This is optional depending on soft reset definition. An optional hydrogen self test functions is carried out at 814. Hydrogen initialization is then done at 816. OBC download is optional (shown as 708) depending on soft reset definition, and is carried out at 818. OBC self test functions again optional, are done at 820. OBC initialization and modem setup are done at 822. Then, the normal OBC and hydrogen operation continues.

**[0079]** If the jumper 411 is on at 800, standalone reset is declared. A reset can then be initiated from the PCI bus by assertion of the RESET# line at 829. Note that the use of # after a signal name indicates an active low signal. This signal holds the OBC in reset at 830 (by the ASIC) for 16,384 clock cycles to ensure stable clock and VCC conditions. After this a complete power up cycle is called at 806. The ASIC then releases the OBC from reset for normal initialization functions to proceed.

**[0080]** When a "soft" reset is initiated via a command from the host at 832, the following sequence is executed by the Hydrogen IC:

- Hydrogen bootstrap (optional depending on soft reset definition) at 834
- Hydrogen self test functions (optional) at 836
- Hydrogen initialization at 838
- Normal Hydrogen operation

**[0081]** The OBC then executes the following sequence:

- Bootstrap from Flash 404 (optional depending on soft reset definition) at 840
- self test functions (optional) at 842
- OBC initialization and modem setup at 844
- normal execution

**[0082]** When the standalone mode is selected, the PC-NIC provides a push button reset capability.

**[0083]** "Dying gasp" is implemented whenever commanded by the Host processor software selected at 706. This function is implemented as part of a controlled power down/shutdown sequence for the Host or a Host application occurring under the control of the Host operating system.

**[0084]** The PCI-NIC can generate a Dying Gasp message 804 responsive to a hard reset initiated by assertion of the PCI bus RESET# line while power is still applied to the PC-NIC. An alternative is shown in Figure 9. This support is provided by allowing the OBC 400, under software control, to enable a SAR-RESET# signal, to generate an interrupt at 902 rather than an OBC reset signal. The OBC then produces the Dying Gasp at 904. The OBC 400 then initiates a self reset at 908 by first disabling the RESET interrupt at 906 and then enabling the RESET signal to the OBC.

**[0085]** This implementation of Dying Gasp requires that the time to generate the dying gasp is less than the time required to start downloading the OBC code. Since a hard reset will initiate a complete restart of the computer and the operating system (on the order of several seconds minimum), the dying gasp message will be complete long before the download of code can begin.

**[0086]** No Dying Gasp message will be generated by unexpected power loss to the PC-NIC.

**[0087]** Switched +12 Volts can also be output to provide remote power for an active caps splitter. This output is current limited to 50 ma. and is intended for application in European markets.

### Hydrogen IC

**[0088]** The Hydrogen IC is completely described in the CL-PS7900 data book from ATML and Cirrus Logic. Functions implemented in this IC include:

- DRAM controller
- PCI bus interface
- Expansion Bus
- Utopial Bus IF
- ATM AFE
- Watchdog Timer
- UART
- GPIO
- Timer

| Hydrogen Memory Map | | |
|---|---|---|
| **Memory Region** | **Start Address** | **Length** |
| RAM | 00000000 | 200000 |
| Config. Regs | 10000000 | C |
| Control/status | 10000100 | 10 |
| List Mgr. regs | 10000200 | 50 |
| Timer | 10000400 | 10 |
| GPIO | 10000500 | 8 |
| UART | 10000600 | 14 |
| Watchdog | 10000700 | 8 |
| PCI | 10000800 | 20 |
| Network config | 10000900 | 18 |
| ASIC Registers | 20000000 | 18 |
| OBC memory | 20100000 | 100000 |
| Modem registers | 20200000 | 10000 |
| * all addresses are in hex notation | | |

### PCI bus interface

**[0089]** The NIC uses the PCI bus interface of the Hydrogen chip to implement the PCI rev. 2.1 interface. The PCI bus pins on the Hydrogen chip 420 is connected to the PCI bus connector 440. Boundary scan on the per bus jumpers TDI to TDO.

**[0090]** The Hydrogen IC 420 requires the two Clock inputs described above. Clock 502 is for the PCI bus interface, and clock 501 is for internal processing. The Hydrogen 420 also generates output clocks for expansion bus operation, system clock, and reference clock.

**[0091]** The PCI Bus Clock input 502 is provided from the PCI bus. It operates at 33.33 MHZ (30 nsec period) maximum. This clock is used for all PCI bus functions and the PCI bus controller.

**[0092]** The ARM system clock input is a 64 MHZ internal system clock that is derived from the 8 MHZ crystal 506. A clock input ClkIn and crystal driver output (ClkOut) are provided on the Hydrogen chip to drive this crystal. The 8 MHZ clock drives an internal phase locked loop that generates the on board system clock. This is used to generate all on board clock signals for the Hydrogen IC.

**Clock outputs**

**[0093]** The following clocks are provided by the Hydrogen IC.

- Expansion Bus Clock 515 16 MHZ
- CLK32 505 32 MHZ system clock

**[0094]** Each clock output is filtered appropriately for electromagnetic coupling considerations.

**[0095]** The Hydrogen IC can include up to 16 Mbits of DRAM.

- 256K X 32 bits
- 512K X 32 bits

**[0096]** The DRAM multiplexed address and CAS/RAS signals are provided by the Hydrogen IC. DRAM resides in address space starting at 10000(h). Each DRAM device is provided with a 0.1 uF decoupling capacitor, and DRAM chips share a single 10 uF decoupling capacitor.

**[0097]** Up to 8Kbits of serial EEPROM 422 is interfaced via the $I^2C$ bus of the Hydrogen chip.

**[0098]** A serial PROM 412 is used to store the PCI configuration parameters and is provided and connected to the GPIO pins.

**Utopia Interface**

**[0099]** The UTOPIA level 1 interface of the Hydrogen IC is connected to the ADSL Modem chip 450, the ASIC 410, which includes a level shifter therein. Connections are as follows:

RXD[0:7] Connected directly to ADSL Modem chip
RXCellAv Connected directly to ADSL Modem chip
RXClk Connected to ASIC to provide data xfer clock
RXSOC Connected directly to ADSL Modem chip
TXCellAv Connected directly to ADSL Modem chip
TXClk Connected to ASIC to provide data xfer clock
TXD[0:7] Connected to ADSL Modem through level shifter
nRXEN Connected to ADSL Modem through level shifter
NTXEN Connected to ADSL Modem through level shifter
TXSOC Connected to ADSL Modem through level shifter

**[drawing]**

**[0100]** Utopia outputs from the Hydrogen IC are TTL outputs. These signals are level shifted by ASIC 410 and routed to the SACHEM IC 460. No tristate of these signals is used.

**[0101]** Inputs to the Hydrogen IC from the SACHEM IC are equipped with 10 Kohm pull up resistors to prevent floating on these lines when the SACHEM outputs are tristated.

**[0102]** Complete I/O specifications for the Hydrogen IC are included in the Hydrogen CLPS7900 data book. Some specific I/O characteristics are:

| Parameter | Min | Max |
|---|---|---|
| Input Low Voltage | -0.5V | 0.8V |

(continued)

| Parameter | Min | Max |
|---|---|---|
| Input High Voltage | 2.0V | VCC |
| Output Low Voltage | | 0.4V |
| Output High Voltage | 2.4V | VCC |
| I/O capacitance | | 10pF |

**[0103]** Output signals from the Hydrogen IC 420 are 5 Volt TTL outputs. Corresponding inputs to the Sachem IC 460 are 3.3 Volt inputs that are not 5 Volt tolerant. A level shift is performed to interface them. Level shifting is performed using a 74LPT244 non inverting buffer or equivalent with propagation delay of less than 5.0 nsec worst case.

**[0104]** Data is transmitted on one edge of the clock and latched on the opposite edge of the clock by the receiver. Skew introduced between the clock and data is a critical parameter to be controlled. The Txclk signal is also routed through the level shifter to minimize skew between the data and clock signals. This results in worst case skew of 3.2 nsec which is negligible at the 16 MHZ (62.5 nsec period).

**[0105]** An 8 KHz clock supplied by the SACHEM modem 460 is routed to GP103. This pin is an 5 volt I/O pin, and has required protection against over voltage conditions being applied to this pin by inadvertent programming of the Hydrogen I/O pin on the PC-NIC.

**[0106]** An optional, debugging, ATM25 interface 423 is used to facilitate firmware and software development. The Utopia interface to the ADSL modem chip is disconnected so that only one of the UTOPIA or ATM25 interface can be used at a time on the Hydrogen chip.

**[0107]** One pin of the Hydrogen GPIO is used to drive the bi-color LED 399. The LED is given to indicate more information about the modem. Red is used to indicate power on, but no ADSL line sync having been established, or that line sync has been lost. Green is used to indicate power on and ADSL line sync established.

**[0108]** The Hydrogen IC DUART I/O pins are connected to a three pin header 424 to assist in software debug and development for run time software.

**[0109]** The power supply layout is shown in Figure 10. The Hydrogen Chip draws its operating power from the PCI bus supplied 5VDC using less than 400 ma of current. Decoupling associated with this device includes a 10 uF cap, and 8 0.1 uF cap.

**[0110]** +5 Volt Power is isolated from the PCB +5 Volt distribution using an inductive element 1002. This creates a +5 Volt Node specific to this IC to which the decoupling is referenced. The clock oscillator use this same unique +5V node.

**[0111]** Boundary Scan pins are connected to test points to allow a boundary scan test of the Hydrogen IC.

**[0112]** The FIG. 4 block diagram shows an ASIC 410. The ASIC provides a control interface between Hydrogen, and the SACHEM modem chip 460, a control interface between the Hydrogen 420 and the OBC processor 400, a level shifter for control signals between Hydrogen 420 and SACHEM 460, a level shifter interface between OBC 400 and SACHEM 460, a DRAM refresh circuit for OBC DRAM 402, and an address Decode and control signal generation for the DUART 470.

**[0113]** The ASIC is implemented in 3.3 Volt logic with a combination of 5 Volt and 3.3 Volt I/O. An FPGA, or logic gates defined using hardware definition language can alternately be used for development or final product. These are implemented using a 3.3 Volt device with 5 Volt tolerant I/O.

## Hydrogen Interface

**[0114]** The ASIC to Hydrogen interface is implemented to allow 5 Volt TTL compatible signals. The ASIC appears to the Hydrogen IC as memory mapped I/O registers, two blocks of expansion memory (OBC memory and Modem registers) on the Hydrogen Expansion bus and as a set of control/interrupt signals. These signals are defined as:

- DQ[3 1:0] Bi-directional address/data bus connected to Hydrogen IC
- IOWait Output to Hydrogen IC to insert wait states
- ALE Input from Hydrogen IC to indicate valid address present
- BusClk Input from Hydrogen providing 16Mhz bus clock
- WRS# Input from Hydrogen indicating write of data to ASIC
- RDS# Input from Hydrogen indicating read of data from ASIC
- RST# Input from Hydrogen indicating Bus reset
- IRQ# Output to Hydrogen for signaling interrupt events from 80960 interface or from the SACHEM interface

### Register definition

**[0115]** Registers reside in the Hydrogen expansion memory space starting at base address 20000000(h). The registers and their offset addresses are:

| | |
|---|---|
| 00 | Control/Status |
| 04 | IRQ Enable |
| 08 | IRQ Source |
| 0C | IRQ Status |
| 10 | OBC mailbox |

### Control Status

**[0116]** Bit definitions for this register are:

| Bit # | | Name | Comments | Reset |
|---|---|---|---|---|
| 00 | R/W | OBC reset | Indicates state of OBC reset line. When set, OBC is reset and SAR has control of OBC bus. When clear OBC has control of OBC bus. | Set |
| 01 | R/W | Modem reset | Indicates state of Modem reset line. When set Modem is reset. When clear Modem released from reset. | Set |
| 02 | R/W | Modem Bus En | Indicates state of Modem bus control. When set the SAR has control of MODEM I/O bus. When clear OBC has control of Modem I/O bus. | Set |

### 3.1.1.2 IRQ Enable

**[0117]** Bit definitions for this register are:

| Bit # | | Name | Comments | Reset |
|---|---|---|---|---|
| 500 | R/W | Modem IRQEN | When set enables IRQ generation from the Modem chipset. When clear IRQ generation is disabled. This function is only operational when the Modem Bus enable line (Bit 2 of Control register) is set. | Clear |
| 01 | R/W | Mbox WIRQEN | When set enables IRQ generation when the OBC writes to the mailbox register. When cleared IRQ generation is disabled. | Clear |
| 02 | R/W | Mbox RIRQEN | When set enables IRQ generation when the OBC reads from the mailbox register. When cleared IRQ generation is disabled. | Clear |

### IRQ Source

**[0118]** Bits in this register are read only. Only IRQ sources that have been enabled are indicated in this register. Any bits set in this register are cleared upon completion of reading this register. Bit definitions for this register are:

| Bit # | | Name | Comments | Reset |
|---|---|---|---|---|
| 00 | R | Modem IRQ | When set indicates IRQ generation from the Modem chipset. This function is only operational when the Modem Bus enable line (Bit 2 of Control register) is set. | Clear |
| 01 | R | Mbox WIRQ | When set indicates IRQ generation from an OBC write to the mailbox register. | Clear |
| 02 | R | Mbox RIRQ | When set indicates IRQ generation from an OBC read from the mailbox register. | Clear |

### IRQ Status

**[0119]** Bits in this register are read only. These bits reflect the status of IRQ sources regardless of enabled/disabled status. This register can be used for polled operation. Bit definitions for this register are:

| Bit # | | Name | Comments | Reset |
|---|---|---|---|---|
| 00 | R | Modem STAT | When set indicates IRQ request from the Modem chipset. This function is only operational when the Modem Bus enable line (Bit 2 of Control register) is set. | Clear |
| 01 | R | MboxWSTAT | When set indicates that the OBC has executed a write to the mailbox register. | Clear |
| 02 | R | MboxRSTAT | When set indicates that the OBC has read the mailbox register. | Clear |

**OBC mailbox**

**[0120]** This register is a 16 bit read/write register that transmits data to/from the OBC. Writes to this register generate an interrupt to the OBC 400 (when enabled by the OBC). When this register is read, data sent by the OBC 400 is provided to the SAR 420. Read actions also generate an interrupt to the OBC (when enabled by the OBC).

**[0121]** Commands and responses to service requests are handled through this mailbox.

**[0122]** The resets control access to certain registers. The OBC reset bit is bit 0 of the control/status register. When set, the SAR 420 has direct read/write access to the 256K X 32 OBC memory block for code/data download or upload. This memory block resides at address 20100000(h) of the Hydrogen expansion bus. When the Modem reset bit 1 of the control/status register is clear, and the Modem Bus En bit 2 of the control/status register is set, the SAR has direct read/write access to the modem registers. This register block resides at address 20900000(h) of the Hydrogen expansion bus.

**[0123]** The ASIC 410 also provides an interface to the OBC 400 to allow communication with the Hydrogen IC 420 as well as to perform level shifting between the OBC bus and the SACHEM 460 bus interface. In addition, the ASIC provides DRAM support for the OBC DRAM bank.

**[0124]** An input pin 411 to select either normal or 960/modem standalone operation is provided. The ASIC interface signals for the OBC are:

- AD[31:0] Time multiplexed Address and Bi-directional Data bus
- CLK2 32Mhz Clock output to OBC
- PCLK Bus Clock input from OBC
- ALE Address Latch Enable input from OBC
- RDY# Output to OBC to insert wait states for accesses
- DEN# Input from OBC indicating data enable
- W/R# Input from OBC indicating read or write
- BE3,2,1,0# Inputs from OBC for byte addressing
- RST# Output to OBC to reset processor
- BLAST# Burst last byte indication from OBC
- INTO# Output to OBC to indicate ADSL modem or Hydrogen IC interrupt
- HOLD Output to OBC to force AD bus to tristate
- HOLDA Input from OBC to acknowledge Hold request

**[0125]** Registers reside in the OBC memory space starting at base address 01000000(h). The-registers and their offset addresses are:

| | |
|---|---|
| 00 | Control/Status |
| 04 | IRQ Enable |
| 08 | IRQ Source |
| 0C | IRQ Status |
| 10 | SAR mailbox |
| 14 | Timer prescaler |
| 18 | Timer #1 divider |
| 1C | Timer #2 divider |
| 20 | Refresh Counter |

**[0126]** Bit definitions for the control status register are:

| Bit # | | Name | Comments | Reset |
|---|---|---|---|---|
| 00 | R | Modem reset | Indicates state of Modem reset line. When set Modem is reset. When clear Modem released from reset. | Set |
| 01 | R | Modem Bus En | Indicates state of Modem bus control. When set the SAR has control of MODEM I/O bus. When clear OBC has control of Modem I/O bus. | Set |
| 02-03 | R/W | WS non burst | These two bits indicate the number of wait states to be inserted for RAM accesses in non burst transactions (These wait states are in addition to any that may be inserted prior to an access due to refresh) | 3 |
| 04-05 | R/W | WS burst | These two bits indicate the number of wait states to be inserted for RAM accesses in burst transactions (These wait states are in addition to any that may be inserted prior to an access due to refresh) | 3 |

**[0127]** Memory speeds supported by each wait state for both burst and non burst accesses are shown below for a bus clock speed of 25 MHZ.

| Wait States | Non Burst Access | Burst Access (2cnd and subsequent accesses) |
|---|---|---|
| 0 | 80 ns | 40 ns |
| 1 | 120 ns | 80 ns |
| 2 | 160 ns | 120 ns |
| 3 | 200 ns | 160 ns |

**[0128]** Bit definitions for the IRQ enable register are:

| **Bit #** | | **Name** | **Comments** | **Reset** |
|---|---|---|---|---|
| 00 | R/W | Modem IRQEN | When set enables IRQ generation from the chipset. When clear IRQ generation is disabled. This function is only operational when the Modem Bus enable line (Bit 1 of Control register) is clear. | Clear |
| 01 | R/W | Mbox WIRQEN | When set enables IRQ generation when the SAR writes to the mailbox register. When cleared IRQ generation is disabled. | Clear |
| 02 | R/W | MboxRIRQEN | When set enables IRQ generation when the SAR reads from the mailbox register. When cleared IRQ generation is disabled. | Clear |
| 03 | R/W | T1IRQEN | When set enables IRQ generation when Timer #1 expires. When cleared IRQ generation is disabled. | Clear |
| 04 | R/W | T2IRQEN | When set enables IRQ generation when Timer #2 expires. When cleared IRQ generation is disabled. | Clear |
| 05 | R/W | GASPIRQEN | When set enables IRQ generation on assertion SAR_RESET# low. When set , an IRQ is generated and OBC_RST# is held off until this bit is cleared. The OBC must generate a dying gasp message in response to this interrupt. The OBC must then clear this bit which | Clear |

**[0129]** Bits in the IRQ source register are set to be read only. Only IRQ sources that have been enabled are indicated in this register. Any bits set in this register are cleared upon completion of a register read.

**[0130]** If an interrupt event occurs during read of this register, the IRQ indication is not registered until the current read access is completed. The IRQ0# output is raised on the completion of each read access of this register. IRQO# is held high for a minimum of one clock cycle before another interrupt is generated. Bit definitions for this register are:

| Bit # | | Name | Comments | Reset |
|---|---|---|---|---|
| 00 | R | Modem IRQ | When set indicates IRQ generation from the Modem chipset. This function is only operational when the Modem Bus enable line (Bit 1 of Control register) is clear. | Clear |
| 01 | R | MboxWIRQ | When set indicates IRQ generation from the completion of a SAR write to the mailbox register. | Clear |
| 02 | R | MboxRIRQ | When set indicates IRQ generation from the completion of SAR read from the mailbox register. | Clear |
| 03 | R | T1IRQ | When set indicates IRQ generation from Timer #1 expiration. | Clear |
| 04 | R | T2IRQ | When set indicates IRQ generation from Timer #2 expiration. | Clear |
| 05 | R | GASPIRQ | When set indicates IRQ generation form an assertion of the SAR_RESET pin low. | Clear |

**[0131]** Bits in the IRQ status register are also read only. These bits reflect the status of IRQ sources regardless of enabled/disabled status. This register is used for polled operation. If a change of state occurs during a read of this register, the change of state is not registered until the current read access has been completed. Bit definitions for this register are:

| Bit # | | Name | Comments | Reset |
|---|---|---|---|---|
| 00 | R | Modem STAT | When set indicates IRQ request from the Modem chipset. This function is only operational when the Modem Bus enable line (Bit 1 of Control register) is clear. | Clear |
| 01 | R | MboxWSTAT | When set indicates that the SAR has executed a write to the mailbox register. | Clear |
| 02 | R | MboxRSTAT | When set indicates that the SAR has read the mailbox register. | Clear |
| 03 | R | T1IRQ | When set indicates Timer #1 expiration. | Clear |
| 04 | R | T2IRQ | When set indicates Timer #2 expiration. | Clear |
| 05 | R | GASPIRQ | When set indicates dying gasp request. | Clear |

**[0132]** The SAR mailbox register 1110 is a 16 bit read/write register that acts as a mailbox. When written to, data 1112 is transmitted to/from the SAR 420. Writes to this register generate an interrupt 1114 to the SAR 420 (when enabled by SAR). When this register is read, data sent by the SAR is provided to the OBC. Read actions also generate an interrupt to the SAR (when enabled by SAR).

**[0133]** Responses to commands and service requests are handled through this mailbox.

**[0134]** The timer prescaler register is an 8 bit R/W register that controls prescaling of the OBC clock. The output of this prescaler feeds both timer counters that can be used to generate interrupts. The expiration of the prescale counter causes generation of a clock to both timer counters. It also restarts counting down from the programmed value 1132 in this register.

**[0135]** The timer #1 divider register is a 16 bit R/W register that controls the division of the prescaler output. When the counter controlled by this register expires, it generates an interrupt and restarts counting from the programmed value.

**[0136]** The timer #2 divider register is a 16 bit R/W register that controls the division of the prescaler output. When the counter controlled by this register expires, it generates an interrupt and restarts counting from the programmed value.

**[0137]** The refresh counter register 1160 is a 10 bit R/W register that controls the refresh rate of the DRAM refresh circuit. Refresh cycles are performed at a rate determined by 1/PCLK * Count. Its default value is set to 300, which results in a refresh period of 40 nsec * 300 = 12 µsec at a clock rate of 25 MHZ (40 nsec period).

**[0138]** Modem register access is controlled by the Modem reset bit. r-bit 0 of the control/status register and the Modem Bus En bit 1 of the control/status register. When both are clear, the Modem Registers reside in the OBC memory space starting at base address 02000000(h).

**[0139]** The ASIC also provides support signals for two blocks of 256K X 32 DRAM 1170. The signals include:

- MA[9:0] Multiplexed Address bus
- RAS[1:0] DRAM row address strobe
- CAS[3:0] DRAM column address strobe
- OE# Output enable
- WR# Write strobe

**[0140]** Refresh of the DRAM 1170 is controlled by the DRAM refresh 116 in the ASIC, in cycles occurring at a rate controlled by the refresh rate register in the OBC memory map. It has a default value of approx. 83 Khz; or a 12 usec period. This provides refresh at a rate for the entire DRAM bank = 512 cycles 12 usec. = 6.144 msec.

**[0141]** A refresh cycle has 8 clock cycles organized as follows:

- All CAS pulled low
- After one clock, All RAS pulled low
- After one more clock, All CAS pulled high
- After three more clocks, All RAS pulled high
- Two cycles are used for recovery

**[0142]** If a refresh cycle is requested during a memory access, the refresh cycles are implemented after completion of the memory access. If an access is requested during a refresh cycle, the RDY line is used to force wait states to allow refresh completion.

**[0143]** DRAM accesses are supported by generation of RASx and CASx signals in conjunction with the top and bottom halves of the address bus. OE# and WR# are generated to perform read or write access. Programmable wait states (0-3) for non burst and burst accesses are supported to allow use of the most cost effective DRAM that meets performance requirements. All multiplexing of the DRAM address bus is performed by the ASIC. Byte accesses and burst accesses are supported.

**[0144]** The ASIC supports operations in standalone, and normal operation depending on the signal received at 401.

**[0145]** When the standalone input pin 401 is pulled high, the ASIC allows the processor 400 to operate in a standalone mode. In this mode, the IBR is read from addresses 1FFF30 through 1FFF60 of the Flash memory 404, by decoding the external bus address and enabling read from the Flash memory.

**[0146]** When the standalone pin is pulled low, the ASIC forces the processor 400 to operate in normal mode with RESET and RAM load being performed under control of the Hydrogen IC 420. In this mode, the IBR is read from the mailbox 1110 by decoding the external bus address and enabling reads from the 426.

**Modem Interface**

**[0147]** Connections between the ASIC and the Sachem Modem 460 include:

- AD[ 15:0] Bi-directional address/data bus.
- PCLK Bus clock
- ALE Input to modem address latch enable
- BE1 Address bit 1
- W/R# Input to modem write/read indicator
- CS# Input to modem chip select
- RDY# Output from modem to indicate transfer ready i.e. wait state insertion)
- INT# Output from modem indicating interrupt req.

**[0148]** All signals between the Modem and ASIC are routed to either the OBC or the SAR based on the state of the Modem Bus Control bit in the SAR status/control register.

**DUART Interface**

**[0149]** The DUART 470 is supported by connection of the following signals:

- CS# is connected to the ASIC to provide address decode functions
- MR is connected to the ASIC to provide reset to the DUART
- RD# is connected to the ASIC
- WR# is connected to the ASIC

**ASIC Power supply**

**[0150]** The ASIC draws its operating power from the 3.3 Volt on- board supply. 5 Volt I/O is drawn from the PCI-bus-supplied 5VDC.

**[0151]** +3.3 Volt Power is isolated from the PCB 3.3 Volt distribution using an inductive element 1004. This creates a +3.3 Volt Node specific to this IC to which the decoupling is referenced.

**[0152]** Boundary Scan pins are connected to test points to allow boundary scan test of the ASIC.

**[0153]** The OBC controller 400 is implemented by a 80960JA-25 processor. This processor requires a 5 Volt supply, and a 25 MHZ clock input provided by an external oscillator 525 to provide the operating frequency for the OBC. The clock input may alternately be supplied by an ASIC clock output pin.

**[0154]** ALE is connected to the ASIC to provide address latching for memory and I/O accesses.

**[0155]** AD31 through AD 1 and DO are connected to the ASIC, and the DRAM bank. AD7 through AD1 and DO are connected to the DUART.

**[0156]** BE0, BE1, BE2, and BE3 are connected to the ASIC and the DRAM bank to allow byte access to memory and I/O. BE0 is connected to the DUART.

**[0157]** RESET# is connected to the ASIC. It is driven low by the ASIC on RESET from the PCI bus. It is driven high or low by the Hydrogen IC via an I/O write to the ASIC. When the RESET# line is driven low by the ASIC, the Hydrogen becomes the bus master for the controller DRAM block. This allows the Hydrogen IC to check the DRAM block during POST and download code for/from the DRAM block.

**[0158]** HOLD is connected to the ASIC. It is driven high by the ASIC to force the OBC AD bus into tristate during reset, and to allow the Hydrogen IC to access OBC memory during operation.

**[0159]** HOLDA is connected to the ASIC. It provides a hold- acknowledge signal to inform the ASIC that the ADBUS is in tristate.

**[0160]** INTO# is connected to the ASIC. INT1# and INT2# are connected to the DUART via pullup resistors.

- INTO# is used to indicate a interrupt request from the ADSL Modem.
- INT 1# is used to signal IRQ1 DUART interrupt
- INT2# is used to signal IRQ2 DUART interrupt

**[0161]** W/R#, DT/R# and DEN# are connected to the ASIC to control memory and I/O reads and writes in conjunction with other address and control signals.

**[0162]** CLKIN is connected to the ASIC for I/O timing.

**[0163]** BLAST# is connected to the ASIC for Burst access support.

**[0164]** READY# is connected to the ASIC and is driven by an ASIC provided wait state generator. This signal is used to insert wait states for memory and I/O accesses.

**[0165]** Signals connected to the DUART include:

- A0 is connected to BE0 of the OBC
- A1 and A2 are connected to A1 and A2 of the OBC
- CHSL is connected to A3 of the OBC Signals pulled up through 1OKohm resistors:
- LOCK# (normal operation)

- INT3-7#
- NMI#
- STEST (option to enable on board self test) Signals pulled down through 10 Kohm. resistors:
    - LOCK# (for use with emulator)
    - STEST (option to disable on board self test) Signals not connected:

    - Width/HLTD1:0

- D/C#
- BSTAT
- AS#
- FAIL#
- ALE#

OBC Memory Map

**[0166]**

| **Memory Region** | **Start Address** | **Length** |
|---|---|---|
| Internal RAM & vectors | 0 | 400 |
| RAM | 00000400 | 100000 |
| ASIC Registers | 01000000 | 24 |
| Modem registers | 02000000 | 10000 |
| DUART | 03000000 | 40 |
| FLASH memory | FEF00000 | 100000 |
| IBR (read from Flash or RAM depending on state of ASIC stadalone pin) | FEFFFF30 | 30 |
| 960 reserved | FEFFFF60 | A0 |
| 960 registered space | FF000000 | 1000000 |
| * all addresses are in hex notation | | |

**OBC interrupts**

**[0167]** The following interrupt sources are supported for the OBC:

| | |
|---|---|
| XINT0# | Interrupt from ASIC used for SACHEM or SAR generated interrupts |
| XINT1# | Interrupt from DUART for channel 1 Async port |
| XINT2# | Interrupt from DUART for Channel 2 Async port |
| XINT3#-XINT7#,NMI# | not used |

**DRAM**

**[0168]** Up to 8 Mbits of DRAM 402 for the OBC are supplied. The configuration of DRAM supported includes:

- 256K X 32 bits

**[0169]** The DRAM multiplexed address, OE#, WR#, CS#, and CAS/RAS signals are provided by the ASIC.
**[0170]** Each DRAM device is provided decoupling capacitors.

**DUART**

**[0171]** A 16552 DUART 470 is provided for debug and development. The DUART resides at base address 03000000 (h) on the controller bus. Register addresses and programming information are included in the data sheet for the DUART. The following connections are made to the DUART:

- A0 and A1 are connected to BE0 and BE1 of the OBC
- A2 is connected to A2 of the OBC
- CHSL is connected to A3 of the OBC
- CS# is connected to the ASIC
- D7 through DO are connected to AD7 through AD1 and DO of the OBC
- INTR1 and INTR2 are connected to the OBC
- MR is connected to the ASIC
- RD# is connected to the ASIC
- WR# is connected to the ASIC
- SIN1, SIN2, SOUT1, and SOUT2 are connected to an RS-232 transmitter receiver IC
- XIN and XOUT are connected to a 18.432 MHZ crystal XOUT is connected through a 1.5Kohm resister 1 Mohm

resistor is connected across the crystal

**[0172]** 47 pF cap is connected to the junction of the 1.5K and 1M res. 22pf cap is connected to XIN

**[0173]** Signals pulled up through 1OKohm resistors:

- RI#1,2
- DCD# 1,2
- DSR#1,2
- CTS#1,2

**[0174]** Signals not connected.

- TXRDY#1,2
- DTR#1,2
- RTS#1,2

**[0175]** The DUART is provided with decoupling capacitors as follows.

**[0176]** An RS-232 driver/receiver 475 such as the MAX203 is used to provide RS-232 compatible levels/thresholds for the two DUART ports. Connections will be as follows:

- T1IN, T2IN connected to SOUT1 and SOUT2 of the DUART
- R1OUT, R20UT connected to SIN1 and SIN2 of the DUART
- T1OUT, T20UT connected to pin 1 of separate 3 pin headers for RS-232 connection
- R1IN, R21N connected to pin 3 of separate 3 pin headers for RS-232 connection
- Ground connected to pin 2 of separate 3 pin headers for RS-232 connection

**[0177]** The RS-232 driver/rec. is provided with decoupling capacitors as follows:

- 1 ea 0. 1 u1F cap.

**[0178]** A block of Flash programmable Memory 404 is provided.

**OBC Power supply**

**[0179]** The OBC draws its operating power from the PCI bus-supplied 5VDC. The current drain should be less than 400 ma. Decoupling associated with this device includes a 10 uF cap and 8 of, 0.1 uF caps.

**[0180]** +5 Volt Power is isolated from the PCB +5 Volt distribution using an inductive element(s) to create a +5 Volt Node specific to this IC to which the decoupling will be referenced.

**ADSL Modem**

**[0181]** The ADSL Modem is implemented using the ADSL-C AFE 450 and the Sachem ADSL modem IC 460. The layout and design of the ADSL modem duplicates the design used by Alcatel in their product utilizing the ADSL-C and Sachem chipset.

**[0182]** The ADSL-C connects to the line interface 452 and the Sachem I.C 460. Connection to the line interface and Sachem is as defined by Alcatel in their current product. Other connections to the ADSL-C include:

PDOWN is connected to the Sachem PDOWN output to implement programmable power down.
Signals pulled down through 10 Kohm resistors:

- LTNT (stuffing option to pull up for LT emulation)

Signals not connected:

- GPO, 1,2

**ADSL Power supply**

**[0183]** The ADSL-C draws its operating power from the 3.3 Volt on- board supply. 3.3 Volt current used is less than 190 ma. Decoupling associated with this device includes 2 - 0.1 μF cap.
**[0184]** +3.3 Volt Power is isolated from the PCB 3.3 Volt distribution using an inductive element 1008 to create a +3.3 Volt Node specific to this IC which the decoupling is referenced.
**[0185]** The ADSL-C also uses the 3.3 Volt analog on-board 0 supply.
**[0186]** Connection to the ADSL-C is as defined by Alcatel in their design using the Sachem and ADSL-C. This is intended to be a "glueless" interface.
**[0187]** Connection to the OBC will be through the on board ASIC to perform level shifting between the 5 Volt OBC and 3.3 Volt Sachem.

- AD [15:0] connected to ASIC for level shift and distribution to/from OBC and SAR PCLK Output from ASIC for 1/0 timing
- ALE connected to ASIC for level shift and distribution to/from OBC and SAR
- BE1 connected to ASIC for level shift and distribution to/from OBC and SAR
- W/R# connected to ASIC for level shift and distribution to/from OBC and SAR
- CSB connected to ASIC for level shift and address decode
- RESETB connected to ASIC for distribution from OBC and SAR
- RDYB connected to ASIC for distribution to OBC and SAR
- INTB connected to ASIC for distribution to OBC and SAR

**[0188]** Connection to the Hydrogen SAR includes the following:

- RXD[0:7] Connected directly to SAR
- RXCellAv Connected directly to SAR
- RXClk Connected to ASIC to provide xfer clock
- RXSOC Connected directly to SAR
- TXCellAv Connected directly to SAR
- TXClk Connected to ASIC through level shifter to provide xfer clock (level shifter included to minimize skew between TXD[0:7] and clock)
- TXD[0:7] Connected to SAR through level shifter
- nRXEN Connected to SAR through level shifter
- NTXEN Connected to SAR through level shifter
- TXSOC Connected to SAR through level shifter

**[0189]** Other connections to the Sachem IC include:

PDOWN output is connected to the PDOWN input pin of the ADSL-C to implement a programmable power down of the AFE in addition to the RESET power down function implemented by reset of the board.

Signals pulled up through 1OKohm resistors:

- SLT_DATA_S0,1
- SLT_DATA_F0,1
- GP_IN0, 1

Signals pulled down through 10 Kohm resistors:

- U_RXADDRO-4
- U_TXADDRO-4
- TESTE

Signals not connected:

- SLR_VAL_S
- SLR_VAL_F
- SLR_DATA_S0,1

- SLR_DATA_F0,1
- SLR_REQ_S
- SLR_REQ_F
- SLAP_CLOCK
- SLR_FRAME_I
- SLT_FRAME_I
- SLR_FRAME_F
- SLT_FRAME_F

**[0190]** The Sachem draws its operating power from the 3.3 Volt on- board supply. 3.3 Volt current used is less than 370 ma. Decoupling associated with this device includes 1 ea 10 uF cap and 8 ea 0. 1 uF cap.

**[0191]** +3.3 Volt Power is isolated from the PCB 3.3 Volt distribution using an inductive element(s). This creates a +3.3 Volt Node specific to this IC which the decoupling is referenced.

**[0192]** Boundary Scan pins are connected to test points to allow boundary scan test of the Sachem IC.

**[0193]** The layout and design of the line interface duplicates the line interface used by Alcatel in their design using the ADSL-C and Sachem chipset. The line interface 452 has a differential driver, a differential receiver, a hybrid coupling circuit, a line coupling transformer, and a High Pass filter. The line interface is transformer-coupled to an RJ- 14 connector 454.

**[0194]** The power supply accepts +5VDC +/- 5% input from either the PCI bus or from an external input connector. 3.3 VDC is derived from this 5 Volt input. Total 5 Volt current will be less than 2 Amps. External connection is supported, e.g., for development purposes.

**[0195]** The power supply 430 generates +3.3 VDC +/- 1% from the 5 Volt input using a linear regulator. Connection to the ON/OFF and FLAG pins when a 5 pin regulator is used are provided to the Hydrogen IC GPIO.

**[0196]** A 0.51 ohm pass resistor is provided to share power dissipation with the 3.3 Volt regulator.

**[0197]** An output capacitor of 22 uF is provided to ensure 1.25 Amp operation with output noise of < 200uV. A 0.22uF capacitor is placed at the input of the regulator.

**[0198]** Analog 3.3 Volts for use by the AFE is derived by an LC filter between the regulated 3.3 Volts and the analog 3.3 Volts.

**[0199]** The power supply accepts +12VDC +/- 5% input from either the PCI bus or from an external input connector. +12VDC current is less than 100 ma. An LC filter is provided for the + 12 VDC used on the NIC.

**[0200]** The power supply accepts -12VDC +/- 10% input from either the PCI bus or from an external input connector. - 12VDC current is less than 100 ma. An LC filter is provided for the - 12 VDC used on the NIC.

**[0201]** External connection is supported as a stuffing option for development purposes only.

**[0202]** As a stuffing option, a DC/DC converter to generate on board +/- 12 Volts DC in place of the PCI bus provided voltages is included. The converter is powered by the PCI Bus 5 VDC and will generate 100 ma output for both + and - 12 VDC.

**ASIC Pin Assignments**

**[0203]** The ASIC is in a 160 PQFP. It supports both 5 Volt and 3.3 Volt I/O.

Pin Assignments

| Description | Type | Pin No |
|---|---|---|
| +3.3V | Power | 1, 41, 61, 81, 121, 141 |
| +5V | Power | 10,46,94,157 |
| GND | Power | 20,31,40,51,70,80,99,100,110,120, 127,137,160 |
| SAR_DA[31:0] | 5VI/O | 2:9,11:19,21:30,32,34,36:38 |
| SAR_RD# | 5VI | 39 |
| SAR_WR# | 5VI | 43 |
| SAR_ALE | 5VI | 44 |
| SAR_BUSCLK | 5VI | 33 |
| SAR_IRQ#/BCLK | 5VI | 35 |
| SAR_RESET# | 5VI | 159 |

Pin Assignments (continued)

| Description | Type | Pin No |
|---|---|---|
| SAR_IOWAIT | 5VO | 45 |
| OBC_DA[0:31] | 5VI/O | 47:50,52:60,62:69,72,74,76:79,82: 86 |
| OBC_ALE | 5VI | 87 |
| OBC_BE#[3:0] | 5VI | 88:91 |
| OBC_W/R# | 5VI | 92 |
| OBC_DT/R# | 5VI | 93 |
| OBC_DEN# | 5VI | 95 |
| OBC_RDY# | 5VO | 96 |
| OBC_HOLD | 5VO | 97 |
| OBC_HOLDA | 5VI | 98 |
| OBC_RESET# | 5VO | 101 |
| OBC_CLKIN | 5VI | 42 |
| OBC_INT# | 5VO | 102 |
| OBC_BLAST# | SVI | 103 |
| OBC_DRAMMA[0:8] | 5VO | 104:109,111:113 |
| OBC_CASO# | 5VO | 114 |
| OBC_CAS1# | 5VO | 115 |
| OBC_CAS2# | 5VO | 116 |
| OBC_CAS3# | 5VO | 117 |
| OBC_RAS# | 5VO | 118 |
| OBC_WE# | 5VO | 119 |
| OBC_OE# | 5VO | 122 |
| MODEM_DA[15:0] | 3VI/O | 126,128:135,138:140,142:145 |
| MODEM_PCLK | 3VO | 146 |
| MODEM_ALE | 3VO | 147 |
| MODEM_BE1 | 3VO | 148 |
| MODEM_CS# | 3VO | 149 |
| MODEM_W/R# | 3VO | 150 |
| MODEM_RDY# | 3VI | 151 |
| MODEM_INT# | 3VI | 152 |
| MODEM_RESET# | 3VO | 153 |
| UTOPIA_TXCLK | 3VO | 155 |
| UTOPIA_RXCLK | 3VO | 156 |
| DUART_CS# | 5VO | 123 |
| DUART_RST | 5VO | 124 |
| FLASH_CS# | 5VO | 125 |
| TMS | 5VI | 73 |
| TCLK | 5VI | 75 |

Pin Assignments (continued)

| Description | Type | Pin No |
|---|---|---|
| TDI | 5VI | 71 |
| TDO | 5VO | 136 |
| STNDALONE | 5VI | 154 |
| RESERVED | N/C | 158 |

**[0204]** The ADSL Network Interface Card (NIC) described above operates using at least one of firmware and/or software for operation.

**[0205]** The ATM portion of the NIC is based on chips, firmware, and software developed by ATM Ltd. for their own ATM network components.

**[0206]** The Network Interface is diagrammed in Figure 12.

**[0207]** The installation routines are made up of four main components (oemsetup.inf, netvlink.inf, vlink.def, and atmncdet.dll). The combination of these four components operates as shown in Figure 13.

**[0208]** Automatical detection of the existence of which ATML NIC card is installed at 1300.

**[0209]** The routine installs the proper utility applications, drivers, ini files, and firmware to support the NIC card chosen by the user at 1302. It then prompts the user for the connection type (Local LAN or ADSL) for the NIC card and configures some initial values for proper operation at 1306. User configurative valves are set, (for example, those shown in Figure 7) at 1308.

**[0210]** Since the installation script format is different for Windows 95 and NT, two "inf" installation scripts are required. The atmncdet.dll library is used to provide user dialogs for gathering information that the scripts could not acquire automatically. This library was written for the MSVC 1.5 development environment.

**[0211]** Vstatus and vcons are performance and status monitoring applications used for troubleshooting problems with the NIC card or with the network itself. The main use for vstatus is for status monitoring of uptime, throughput, and system connections as needed. For example, the ARP server, LECS server is used as the Windows environment.

**[0212]** Vcons is a DOS console type application that is used as a terminal type connection to the NIC card. This application allows a user to send commands manually to the firmware and see the response.

**[0213]** Asock32 or the ATM Sock API is a proprietary API developed by ATML. This interface was designed to conform to Microsoft's guide to extending the Windows Socket API version 1.1. See WinSock documentation by Microsoft for further details. Unfortunately, ATML does not conform to Microsoft's guidelines completely. This library is coded for the MSVC 2.2 development environment using an updated Win32 API.

**[0214]** Vsock is the ATM Sock Interface protocol. This is a proprietary protocol with a .vxd or Virtual Device Driver used by ATML which Hayes has purchased the rights to redistribute. This allows any application developed by third parties that use the ATML atmsock API to operate correctly with the Hayes NIC card. This module was coded to comply with MSVC 2.0.

**[0215]** The final component to the ATMPC SDK/DDK is the vlink module. This module is the network VXD that vsock and all other protocols communicate to pass data into a network. This module has been developed to work with Windows 95 and NT using NDIS 3.0. The driver's function is limited to only act as a communication interface between the protocol layer and the hardware (NIC) layer. ATML designed all of the encapsulation components for passing other protocols over ATM in the firmware. This driver supports NDIS 3.0 only and was coded to be compiled with MSVC 4.0.

Software Requirements

**[0216]** Figure 14 shows the Network Interface Diagram with the present hardware components described with reference to Figures 4 to 11.

**[0217]** Installation Routines include the oemsetup.inf, hnetinst.inf & atmncdet.dll. User Control and Monitoring Applications include the ServiceMonitor, AdslNicP, and NicCons. Protocol Device Driver is the hAtmSock. Network Device Drivers includes hNetLink and hOdiLink. Their corresponding ATML modules are Installation Routines (oemsetup.inf netvlink.inf, vlink.def atmncdet.dll), Status Applications (vstatus and vcons), Native ATM Protocol (vsock), and Network Device Driver (vlink) respectively.

**[0218]** In Windows 95/98 and other plug-and-play operating systems, the OS identifies the NIC at boot-up as new hardware through the PCI plug-and-play capability at 1300. This brings up the screen of Figure 15. For Windows NT 3.51/4.0 the user may have to manually select to install a new network adapter and select "Have Disk" to identify the NIC as shown in Figure 4. Once the card is identified, the user is prompted to install drivers for this new hardware. The present installation routines use oemsetup.inf (Used for NT) and hnetinst.inf that is required according to Microsoft's guidelines for hardware and a support library. ATML's routines including oemsetup.inf, netvlink.inf, and vlink.def are used.

**[0219]** ATML's setup files are stripped of unnecessary product support. Together with the support library these routines perform the following shown in Figure 17:

1. Identify the Hayes ATM/ADSL NIC card at 1700.
2. Decompress and copy the supported applications, drivers and firmware files to the local system drive upon user request at 1702.
3. Create all registry entries needed for these applications to start up correctly at 1704.
4. Detect if networking is installed on the Windows OS and prompt the user if these components need to be installed at 1706.
5. Insure that the hAtmSock (Native ATM Protocol) device driver is setup correctly as a network protocol and also insure that the Microsoft TCP/IP protocol is installed at 1708.

**[0220]** A number of additional User Control and Monitoring Applications are used.

**[0221]** The AdslNicP Network Control Panel Extension Library provides the NIC global properties from the Network Control Panel Applet when a user selects properties for the NIC adapter/ Figure 18 shows a screen shot of AdslNicP.exe.

**[0222]** Changing any of these parameters changes the network. Since these settings are set at startup, they cannot be dynamically changed after the NIC card is in an operational state. This requires the PC System to be rebooted for the changes to take effect. Hence, these changes cause a "BIND" action.

**[0223]** As shown in Figure 18, this application provides a simple graphical interface for users to change global ATM parameters. This interface enables and disables the ILMI. If ILMI is disabled, then the dialog prompts for a proper ATM address.

**[0224]** The interface allows setting global signaling for SVC (Switched Virtual Circuits) connections.

**[0225]** The interface sets the connection mode for permanent connections (PVC or PVP).

**[0226]** It also provides selection for alternate protocol support such as IP over ATM or PPP over ATM.

**[0227]** The box also allows LLC-SNAP to be disabled for VC Multiplexing.

**[0228]** Finally, the system determines when the user has made changes to the global settings so a bindery action can be called for the network components. This action prompts the user to reboot before changes will take affect.

**[0229]** The routine also provides a means of saving and restoring a single working configuration in case the user makes a change that disables the network.

**[0230]** The ServiceMonitor Application has a function to allow the user of a Hayes ATM/ADSL NIC Modem PCI card to manage the network interface and obtain performance information about the network connections. This application must be executed before any network service connections can be established. Software interface provides the functions and applications.

**[0231]** The interface uses a Simple Connection Status and Problem Indication. An LED style of status indication similar to the front panel of an analog modem is used. This is accomplished by providing a System Tray Icon in Windows 95 and NT 4.0 system tray as shown in Figure 19). For Windows 3.5x this is accomplished by centering the Tray Icon on the left side of the main dialog (See Figure 6).

**[0232]** The Tray Icon is formed of three artificially simulated LED's. The left represents transmissions of data. The right represents data received. These two LED's alternate between dark red and bright green colors for data movement. Bright red indicate some sort of error in the data flow. The center LED is used to indicate line sync with the ADSL Modem. For this LED, red indicates loss of sync and bright green is the normal condition. This functionality is provided by 9 separate icons which are selected based on the states of variables discussed above.

**[0233]** The System Tray Icon 1910 responds to various mouse actions. It allows the user to easily acquire global status information about the network interface. A Right Mouse Click brings up a System Menu 1920 displaying optional actions to provide the user with some information about the connection status of some selected services. As Figure 19 above shows, the two services installed (BlockBuster 1920 and MindSpring 1921) as inactive due to the dark red LEDs 1922, 1924 to their left. If either of them were active, their associated LED turn bright green.

**[0234]** Left Mouse Click on the System Tray Icon brings up the main dialog 1900. The main dialog has global performance information 1905 that can be used to track data flow, connection time, and number of installed services. The connection time and flow rates can also be obtained through a ToolTip feature. When the mouse is positioned on the Tray Icon for approximately one second, connection time and flow rate are displayed.

**[0235]** The Service Connection Performance and Network Configuration is shown in Figure 20.

**[0236]** Under normal operating conditions, when the user selects "Properties" from the main dialog, the Properties dialog is displayed (as shown in Figure 20) only three main tabs -- Services, ATM Interface, and Options. The two modem tabs are meant to be used for troubleshooting modem problems. These are defaulted to not display from the "Options" tab. The default tab to be displayed is the "Services" tab. This control style is a Property Sheet with Property

Page Dialogs for tabs. All of the installed service connections are be displayed from a tab control to allow ease of service selection. The installed service tab names are user-configurative to allow customization. This installed service are placed on the Tray Icon system menu at the users request from the "Options" tab.

**[0237]** The user interface also provides performance data on all individual connections. To accomplish this, all service connections have the same performance data displayed upon selection of the service tab. This minimizes control creation and provides a consistent user interface to all performance data.

**[0238]** Performance data is acquired on 0.5-second intervals. The performance graph is an owner-drawn control created at run time with a ten-second history. User configurative parameters include changing the line colors for data representation.

**[0239]** When the user wants to verify connection parameters for any service, they can select the tab of the service to verify and then select "Properties". This brings up a static view of the connection settings for that service as shown in Figure 21.

**[0240]** Figure 21 shows the network Configuration Properties Dialog (Service Properties). The Service Connection Modification of Network Configuration allows the user to manually adjust the connection parameters. "Modify" (See Figure 21 above) is selected from the "Service Properties" dialog. This brings up the "Modify Service" dialog and the previous dialog "Service Properties" disappears. If the service being elected to modify were being actively connected, then a warning dialog appears notifying the user that any changes to an active service could cause loss of data. This warning dialog allows the user to cancel the modify action or continue to bring up the Modify dialog. While the user is in the modification dialog, changes can be made to any of the connection parameters including alteration of the tab name.

**[0241]** Figure 22 shows the User Interface Screen to Modify Network Configuration Dialog. This interface allows the user to configure the ATM parameters on a per connection basis as needed. This interface also has enough intelligence to prevent incorrect parameters from being configured (ie. Invalid VPI or VCI values, Policing of Specified Cell Rates to prevent exceeding Max Upstream bandwidth, etc.).

**[0242]** For any service that is using any IP protocol over ATM, the "Settings" button is enabled and brings up a configuration dialog shown in Figure 23 for that protocol if selected.

**[0243]** This configuration dialog provides a great amount of flexibility to the user. For a PVC connection using Routed IPoA, the user can elect to use the gateway IP address already configured in the TCP/IP protocol stack as the destination machine to connect to the Ethernet LAN. If the connection is a machine other than the gateway, then the user needs to provide the IP address of that machine to complete the connection. This configuration is simplified by the use of SVC's or Bridged IPoA. This interface satisfies the need for allowing multiple service configurations.

**[0244]** If a service is Active, then the "Stop" button 2100 in Figure 21 is enabled to allow the user to disable the service that could potentially be using required bandwidth that another service may need. This allows a user to properly manage connections without having to install and reinstall them when it is necessary to temporarily disable the service. This control disconnects all active connections to that particular service and does not allow any new connections for a 2-minute interval. After 2 minutes, then any new applications started can use the service.

**[0245]** Time delay is used instead of a set/reset type of function to avoid the user forgetting that the service has been disabled, and thinking that another problem exists. With an auto reset functionality the state of the service connection can be returned to normal without any other user interaction.

**[0246]** Figure 24 shows the Service Installation Wizard Dialogs
Status of Global ATM Connection Performance and Configuration. The ATM Interface dialog displays global performance data and configuration setting to the user. This dialog is intended to be used for providing ISP's with configuration information in the event that a service installation fails or is working improperly. The connection status information is static and cannot be altered by the user in this application.

**[0247]** Figure 25 shows Global ATM Network Performance and Configuration. The connection configuration should not be configured at an application level since a Network Bindery action is needed to complete and properly reconfigure. This action is required since this data is initialized for the ATM/ADSL NIC Adapter only at boot-up of the OS.

**[0248]** The ADSL Modem Performance and Operational Status is shown by the status monitoring application which displays ADSL modem performance. The two dialogs shown in Figure 25 accomplish this task by statistically displaying modem performance. These dialogs were not designed for the novice user since the intent of these dialogs is to be used for troubleshooting problems with the ADSL modem. The dialogs were designed with the assumption that the user viewing them has some advance degree of knowledge with ADSL technology. These dialogs are normally turned off for viewing through the "Options" tab dialog as shown in Figure 26 below.

**[0249]** As with almost all applications, flexibility to meet different consumer needs and preferences is usually considered and configured as optional features or selections. These components do not impact the ability of this application to perform the required task of managing the Modem adapter and its varying flavors of interfaces. They provide the user with some ability to tailor that interface to meet varying preferences. This also allows to meet certain needs of the hardware that require configuration options (ie. POST selection, Restoration of default settings, etc.).

**[0250]** The Figure 26 dialog includes optional configuration parameters tab dialog. This dialog also provides a means of saving or restoring profile settings. This will be a method of networking for many users. It is expected that the user would need some method of restoration to a known working configuration. These optional functions allow saving and restoring of profiles on a global basis.

**[0251]** The NicCons application's main function is to act as a troubleshooting tool for problems that could potentially occur outside the scope of ServiceMonitor's control or status monitoring. This application allows the user to work from a command line and send single commands to the NIC and obtain the NIC's response to those commands

**[0252]** This application carries out the following features:

1. Allows command line communication through a DOS Console to running processes residing on the NIC.
2. Switches between three main control processes:

   a) Hydrogen - This process is the main entry into the ATMos kernel.
   b) SNMP - This process allows a user to send out SNMP calls to the NIC cards MIR
   c) Modem - This process is the interface between the Hydrogen and the processor which controls the ADSL modem backbone.

**[0253]** The vsock protocol device driver from ATML is used as a Protocol Device Driver. This allows supporting any application developed using ATML's API without supporting the API itself. The file name will change to hAtmSock.vxd to simplify recovery of the driver if a user installs an ATML product on the same PC system.

**[0254]** Since ATML implemented the native ATM protocol in firmware, the protocol socket is actually a simple connection for passing data off to the driver and then to the firmware. This allows a user application to communicate to the protocol directly implemented in the firmware OS where all PDU's (Protocol Data Units) are actually assembled and disassembled. This model allows ATML to port the protocol socket easily to any platform and implement all <Protocol stack's> over ATM directly on the Hydrogen chip.

**[0255]** The existing driver that ATML provided is simply a plain communication module for sending and receiving data between the protocol stacks and the NIC (Firmware on Hydrogen chipset) as shown in Figure 4 above. It only supports NDIS 3.x under Windows 95 and NT. Our requirements for this driver is the same with minor enhancement for asynchronous throughput and support of the processor chip.

**[0256]** This driver operates as follows and as shown in Figure 27:

1. Initiate POST (Power on Self Test) sequence for both NIC and Modem in full or reduced mode as set by ServiceMonitor. The duration of the POST sequence shall be less than 5 seconds at 2700.
2. Ensure the following sequence of events occurs in less than 1 second:

   a) Download Hydrogen image at 2702.
   b) Download 1960 image at 2704.

3. Provide communication interface between all supported protocols and the NIC at 2706.
4. Provide I/O status and error conditions to ServiceMonitor NIC management application.

**[0257]** The hNetLink NDIS 3.x Network Virtual Device Driver supports Windows 95 (ver A and OSR2), Windows NT 3.51 (all Service Packs) and Windows NT 4.0 (all Service Packs). The supported protocol stacks for this driver are Microsoft TCP/IP, NeBEUI, and ATML's Native ATM. This driver also supports the Windows 98 OS as well with Microsoft's Native ATM Protocols.

**[0258]** hOdiLink Netware ODI Virtual Device Driver driver supports the Novell ODI Network Interface under the following versions, Novell Netware 3.12, 4.x, and Novell IntranetWare. The protocol stacks supported are Novell TCP/IP and IPX/SPX.

The API for hAtmSock protocol device driver is used for all Native ATM communications and for all management applications (ServiceMonitor, NicCons, etc.). This is a required driver for this product. The method of communication for applications to this driver is through obtaining a handle to the driver using "CreateFile" as shown:

**[0259]** For Windows 95:

```
             hDriver = CreateFile ("\\\\.\\vhadslid"
GENERIC-READ I              GENERIC-WRITE, FILE_SHARE_READ
I                 FILE_SA\HARE_WRITE NULL, OPEN EXISTING,
FILE FLAG                WRITE THROUGH I FILE FLAG
OVERLAPPED  I               FILE_ATTRIBUTE_NORMAL, NULL);

        For Windows NT:
             hDriver = CreateFile ( "\\\\.\\khadslid"
GENERIC-READ I              GENERIC-WRITE,FILE_SHARE_READ
I FILE - SHARE              WRITE, NULL,OPEN EXISTING,
FILE_FLAG WRITE THROUGH              I FILE - FLAG -
OVERLAPPED I                FILE_ATTRIBUTE_NORMAL, NULL);
```

**[0260]** Once the handle is acquired then all communication is done using the Win32 function **"DeviceIoControl".** The dwIoControlCode member is what applications will use to communicate with all devices from this protocol and below. The following control codes are created by using the CTL_CODE macro defined in WINIOCTL.H (macro: CTL_CODE( DeviceType, Function, Method, Access ) ). For our applications the DeviceType, Method, and Access will always be FILE_DEVICE_NETWORK, METHOD_OUT_DIRECT, and FILE_ANY_ACCESS respectively. The code of interest to the applications is the "Function" member. This member falls within the range of 0x800 to 0xfff. The 0x800 to 0xbff range is used for legacy code from ATML and the 0xc00 to 0xfff range is used for any new codes defined by Hayes for this project. To ensure that this range is maintained, all control codes begin with 0x00 and use the macros below to get the base address.

```
#define SM_FCMIN 0X800
#define SM_FC_ATMADSL Oxc00
```

**[0261]** Table 1 below defines the codes used by this protocol.

Table 1 -

Control Codes for Establishing and Communicatinq with ATM Socket Connections

| **Function** | **Old ATML Macro** | **New Macro** | **Control Code** | **Description** |
|---|---|---|---|---|
| AtmVsSocket | VS_IOCTL_SOCKET | SM_IOCTL SOCKET | 0x001 | Open Socket |
| AtmVs Close | VS_IOCTL_CLOSE | SM_IOCTL_CLOSE | 0x002 | Close Socket |
| AtmVsConnect | VS_IOCTL_CONNECT | SM_IOCTL CONNECTION | 0x003 | Connet to Socket |
| AtmVsSend | VS_IOCTL_SEND | SM_IOCTL_SEND | 0x00a | Send Data to Socket |
| AtmVsQueueRecvBuf | VS_IOCTL_QUEUE_RECV BUF | SM_IOCTL_QUEUE_RECVBUF | 0x00c | Set Received Buffer |
| AtmVsRecv | VS_IOCTL_RECV | SM_IOCTL_REVC | 0x00e | Not Used For Now |
| AtmVsDebug | VS_IOCTL_DEBUG | N/A | 0x000 | Not Used For Now |
| AtmVsListen | VS_IOCTL_LISTEN | N/A | 0x004 | Not Used For Now |
| AtmVsAccept | VS IOCTL ACCEPT | N/A | 0x005 | Not Used For Now |
| AtmVsReject | VS_IOCTL_REJECT | N/A | 0x006 | Not Used For Now |
| (Not Implemented) | VS_IOCTL_BIND | N/A | 0x007 | Not Used For Now |
| AtmVsGetSockName | VS_IOCTL_GETSOCKNAM E | N/A | 0x008 | Not Used For Now |
| AtmVsGetPeerName | VS_IOCTL_GETPEERNAM E | N/A | 0x009 | Not Used For Now |
| AtmVsCancelSend | VS_IOCTL_CANCELSEND | N/A | 0x00b | Not Used For Now |
| AtmVsCancelRecv | VS_IOCTL_CANCEL_REC V | N/A | 0x00d | Not Used For Now |
| (Not Implemented) | VS_IOCTL_GET_RECVBU FLEN | N/A | 0x00f | Not Used For Now |
| (Not Implemented) | VS_IOCTL_SET_RECVBU FLEN | N/A | 0x010 | Not Used For Now |
| (Not Implemented) | VS_IOCTL_FLUSH_RECV DATA | N/A | 0x011 | Not Used For Now |
| (Not Implemented) | VS_IOCTL_CIRCULARBU FFER | N/A | 0x012 | Not Used For Now |
| (Not Implemented) | VS_IOCTL_GET_CIRCBU FF | N/A | 0x013 | Not Used For Now |
| AtmVsSelect | VS_IOCTL_ASYNCSELEC T | N/A | 0x014 | Not Used For Now |
| AtmVsSetQos | VS_IOCTL_SETQOS | N/A | 0x015 | Not Used For Now |
| AtmVsGetQos | VS_IOCTL_SETQOS | N/A | 0x016 | Not Used For Now |
| AtmVsSetLowMark | VS_IOCTL_SETLOWBUF | N/A | 0x017 | Not Used For Now |

Table 1 - (continued)

| Control Codes for Establishing and Communicatinq with ATM Socket Connections | | | | |
|---|---|---|---|---|
| **Function** | **Old ATML Macro** | **New Macro** | **Control Code** | **Description** |
| AtmVsSockIoctl | VS_IOCTL_SOCKIOCTL | N/A | 0x018 | Not Used For Now |
| AtmVsGetVersion | VS_IOCTL_GETVERSION | N/A | 0x019 | Not Used For Now |
| AtmVsAddParty | VS_IOCTL_ADDPARTY | N/A | 0x01a | Not Used For Now |
| AtmVsDropParty | VS_IOCTL_DROPPARTY | N/A | 0x01b | Not Used For Now |

**[0262]** Presently, there are no new control codes needed for this protocol. As shown in Table 1 above, only 6 existing codes are to be used by the management applications. These codes are used to establish a connection to the Hydrogen for SNMP calls.

**[0263]** API for hNetLink was created by ATML to be a MiniPort network driver with minimal functionality for passing data, downloading firmware images and INI files, etc. At present, there are no control codes to be used by this driver. This driver is accessed by the Sock Protocol driver through NDIS and has no direct interaction with this driver.

**[0264]** Communication to the ATM module (Hydrogen Chip) uses the following control mechanism.

```
                #define NIC_CTLCM D(Destination, Source, OpCode,
         DataSz) I




             ((Destination << 24) 1 (Source << 16) 1 (OpCode <<
     8) 1 (DataSz)

             #define STRIP CTLCODE                     255L
             #define CTLCMD DEST(NICCtlCmd)      ( NicCtlCmd >>
     24
             #define CTLCMD_SOURCE(NicCtlCmd)    ((NicCtlCmd >>
     16) & STRIP
     CTLCODE)
             #define CTLCMD_OPCODE(NicCtlCmd)    ((NicCtlCmd >>
     8) & STRIP -                                     CTLCODE)
             #define CTLCMD_DATASZ(NicCtlCmd)    (NicCtlCmd &

     STRIP_CTLCODE)
```

using the format shown in Figure 28.

| one byte | one byte | one byte | one byte | n bytes |
|---|---|---|---|---|
| destination address | source address | opcode | length of data(n=lenx 4) | data field with opcode-specific format |
| MSB | | | | LSB |

**[0265]** This is based on Management & Control Entity Addresses shown in Table 2.

| Entity | Address |
|---|---|
| Host Management Application | 0x01 |
| Host Data Handler | 0x02 |
| Host Debug Port A | 0x03 |
| Host Debug Port B | 0x04 |
| Host Debug Port C | 0x05 |
| Host Debug Port D | 0x06 |

(continued)

| Entity | Address |
|---|---|
| Host Service & Test Application | 0x07 |
| OBC Management Application | 0x10 |
| OBC Selftest Agent | 0x11 |
| OBC Debug Process 1 | 0x12 |
| OBC Debug Process 2 | 0x13 |
| OBC Debug Process 3 | 0x14 |
| OBC Debug Process 4 | 0x15 |
| Hydrogen Debug Process 1 | 0x20 |
| Hydrogen Debug Process 2 | 0x21 |
| Hydrogen Debug Process 3 | 0x23 |
| Hydrogen Debug Process 4 | 0x24 |
| Hydrogen Management Interface | 0x25 |
| Reserved for SYNC | 0x55 |
| Reserved for SYNC_ACK | 0xAA |
| Reserved for SYNC | 0x33 |
| Reserved for SYNC_ACK | 0xCC |

Table 3

| shows Management Commands | | | |
|---|---|---|---|
| **Command** | **Opcode** | **Data Field Length** | **Data Field Contents** |
| NIC_INIT_CONN_TABLE | 0x01 | (n) | Installed Services (VC's) |
| NIC_REINIT_CONN_TABLE | 0x02 | (n) | New Connection Table |
| NIC_CREATE_CONN_ENTRY | 0x03 | (?) | New VC Entry |
| NIC_REMOVE_CONN_ENTRY | 0x04 | 4 | VC Entry Value |
| NIC_UPDATE_CONN_ENTRY | 0x05 | (?) | VC Entry Data |
| NIC_REMOVE_CONNECTION | 0x05 | 4 | VC Connection Value |
| NIC_SUSPEND_CONNECTION | 0x06 | 4 | VC Connection Value |
| NIC_VC_PERF_DATA | 0x07 | 4 | VC Connection Value |
| NIC_ALL_VC_PERF_DATA | 0x08 | 0 | N/A |
| NIC_PROCESS_INI_SETTIN GS | 0xAO | 0 | N/A |
| NIC_MULTIPLE_COMMANDS | 0xDO | 8 or> | Mult. Commands |

Detailed Component Design

**[0266]** Common code headers and guidelines for code development for all software components simplify moving across multiple projects with greater efficiency. Development Language (Compilers, Linkers, etc.)

**[0267]** All components of this product are preferably compiled with Microsoft Visual C++ Version 5.0. The only exception is the Device Drivers that may need MASM as well. Since this card is targeted for a PCI bus, assumptions are made that the target systems will be Intel Pentium based. The following compiler options are used for release builds except where noted:

1. General

    a) Warning level set to "3".
    b) Optimizations set to "Minimize Size".
    c) Preprocessor definitions:

        NDEBUG,WIN32,_WINDOWS,_CPLUSPLUS

2. C++ Language

    a) Pointer-tomember representation method set to "Best-Case Always"
    b) Enable exception handling.

3. Code Generation

    a) Processor set to "Pentium"..
    b) _cdecl Calling convention.
    c) Run-time Libraries linked statically using Multithreads.
    d) Struct member alignment should be set to 8 Bytes.

4. Do not use precompiled headers.
5. All defined preprocessor definitions should be in Upper Case and they should begin and end with ' ' characters.

**[0268]** The linker options for release builds should not be set for incremental linking. If a project has settings other than these listed, it is noted inside the project Readme.txt file.

Project Source File Names and Required Files

**[0269]** Guidelines include the following:

1. Do not restrict file names to an 8.3 format unless there is cause to do so.
2. Files containing C++ code should have a cpp extension and files that contain ONLY C code should have a.c extension.
3. All headers will have a.h extension.
4. Class objects that will be used in multiple source files should be contained in separate source files. For these types of objects the filename should be the name of the Class excluding the "C" header if used (ie. CmyClass - filenames are MyClass.cpp and MyClass.h).
5. For source files that contain only "C" code, the file should contain related functions that correspond to a package of features. The feature should some how be related to the filename (ie. NicComm.c - Source file contains functions for sending and receiving data to a NIC card).

**[0270]** All projects should contain the following folders for source code organization:

1. Source Files - Files that have extensions "cpp;c;cxx;rc;def-,r;odl;idl;hpj;bat".
2. Header Files - Files that have extensions "h;hpp;hxx;hm;inl".
3. Resource Files - Files that have extensions "ico;cur;bmp;dlg;rc2;rct;bin;cnt;rtf;gifjpgjpegjpe"
4. Help Files - Files that have extensions "cnt;rtf'.
5. Documents - Files that have extensions "doc;txt;pdf".

**[0271]** On the main project branch there are three files included with every project. These files are described as follows:

1. Readme.txt - This file contains a detailed description of the module developed (this can be taken from this document). It also contains any exceptions to this specification and why they are needed.
2. ScodeS.txt - This file contains the standards used for all source code within that module, if different than these guidelines. The creators standards must at least meet or exceed those mentioned in this document.
3. <Pname>.reg - This file contains all registry entries needed for this module. This file is used by the installation routines to properly install this module.

Example. reg file for ServiceMonitor:

REGEDIT

**[0272]** ;This REG file may be used by your SETUP program.
;If a SETUP program is not available, the entries below will be
; registered in your InitInstance automatically with a call to
;CWinApp::RegisterShellFileTypes and
OleObjectFactory::UpdateRegistryAll.
HKEY_CLASSES_ROOT\ServiceMonitor.Application - ServiceMonitor Application HKEY_CLASSES_ROOT\ServiceMonitor.Application\CLSID={497A0
BC5-2561-11D1 -SAF8-00805FCDE 1138)
HKEY_CLASSES_ROOT\ServiceMonitor.Application\CurVer - ServiceMonitor.Application. 1.0
HKEY_CLASSES_ROOT\CLSID\{497A0BC5-2561-1
1D1-8AF8-00805FCDE1B8} = ServiceMonitor Application
Guidelines for "C" Source Code Development

**[0273]** This project contains a large amount of 3rd party developed source code that is exempt from this standard. Also, if your module contains an ScodeS.txt file that does describe an alternate code standard, then these standards do not apply. If any work is to be done to enhance the third party application in terms of new code then this guideline is followed. If the work to enhance third party code is simple bug fixing or minor alteration then attempt to conform to the standard present inside the existing code.

1. All macros and enum types are in Upper Case unless noted.

```
Example:  #define MY _MACRO   0xffffffff
          typedef enum {
          MY-FIRST - VALUE,
          MY_SECOND_VALUE
          }MyEnumType;
```

2. All functions used inside multiple source files (.c) start with a lower case letter.
    Example: void myExportedFunction (int myData);
3. All user defined data types and structures are configured as shown below:

```
Example: typedef struct -myStructData{
........
      MyStructData, *MyStructDataLP;
      typedef long MyDataType;
```

4. All function definitions have a comment header as shown below (Note: The Argument section is only needed if the function has arguments):

```
// Function name    :myExportedFunction
```

```
          // Description      :This function does nothing.
          // Return type      :void
          //Argument          :int myData - This is used for
      data                    input.
```

Guidelines for "C++" Source Code Development

**[0274]** Same as "C" source code in section 4.1.3 with addition of Class creation as follows:

1. All class declarations begin with "C" (ie. class CMyClass -.).
2. All data is encapsulated (private) unless otherwise noted. If the information is not in its encapsulated state, the reason is in the ReadMe.txt file for your project or within the source code with comments.
3. All member functions begin with a capital letter (ie. void CmyClass::MyFunction

**[0275]** The Oemsetup Setup Information File is the Installation Setup script for the ATM/ADSL NIC product.

**[0276]** The Atmncdet Setup Extension Library is used with the setup script for executing routines that the script could not support.

**[0277]** The AdslNicP Network Control Panel Application is an extension DLL is the "Properties" screen for the NIC Adapter Card launched from the Network Control Panel Applet. This DLL provides the interface for modifying the global ATM and ADSL parameters. This interface is dialog-based and signals the OS when a network bindery action takes place. It also allows the user to save the present settings as the default and restores default settings upon request.

**[0278]** Main Dialog Class (AdslNicP.h) object is designed to interface with the user through a dialog based user interface. It is responsible for displaying to the user the current global ATM interface settings and allow him/her to make changes easily. Upon any changes being made and the dialog closing, this object updates the bindery information for all network components through the Network Control Panel Applet. If a change is made that is out of scope with the capability of this NIC then this object notifies this information to the user and provides possible alternative parameters.

**[0279]** The AdslNicP.h header contains the class member functions and data needed to implement the "Properties" dialog referenced in Figure 5 above. This file requires data referenced in other header files to implement this class object properly (ServiceMonitorData.h, resource.h).

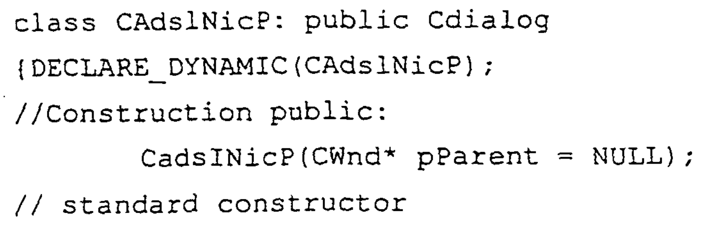
**[0280]** The following controls are defined in resource.h:

| | |
|---|---|
| IDCBM_CORPLOGO | Hayes Microcomputer Products, Inc. Company bitmap logo |
| IDCS_FIRM_VENDVER | Firmware Vender and Version static label |
| IDCG_ATMCONFIG | ATM Configuration group |
| IDCCKB_ILMIENABLED | ILMI Enabled Check Box |
| IDCS_ATMADDRESS | ATM Address Static Label |
| IDCE_ATMADDRESS | ATM Address Edit Control |
| IDCS_LINERATE | Purchased Line Rate Static Label |
| IDCE_LINERATE | Purchased Line Rate Edit Control |
| IDCS_LINERATE_UNITS | Purchased Line Rate Units Static Label |
| IDCCKB_DISLLCSNAP | Disable LLC-SNAP for IP over ATM Check Box |
| IDCG_SIGNALING | Signaling Group Control |
| IDCRB_UNI31_SIG | UNI 3.1 Signaling Radio Button Control |
| IDCRB_UNI40_SIG | UNI 4.0 Signaling Radio Button Control |
| IDCG_CONNMODE | Permanent Connection Mode for ATM card |
| IDCRB_PVCMODE | Permanent Virtual Circuit Radio Button Control |
| IDCRB_PVPMODE | Permanent Virtual Path Radio Button Control |

(continued)

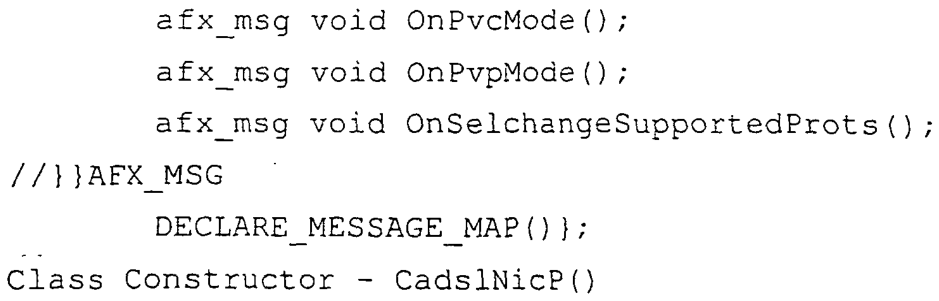
| | |
|---|---|
| IDCS_SUPPORTECPROTS | Additional Protocol Support Static Label |
| IDCCB_SUPPORTEDPROTS | Additional Protocol Support Combo Box |
| IDCB_OK | OK Button Control |
| IDCB_CANCEL | Cancel Button Control |
| IDCB_SAVESDEFAULT | Save As Default Button Control |
| IDCB_RESTOREDEFAULT | Restore Default Button Control |

**[0281]** The class header is shown below:



```
class CAdslNicP: public Cdialog
{DECLARE_DYNAMIC(CAdslNicP);
//Construction public:
        CadsINicP(CWnd* pParent = NULL);
// standard constructor
```

```
        virtual -CAdslNicP0;
// Dialog Data

private:
        SMDGlobalATMSettings m - GlobalSettings;
        bool mb_SettingsModified;
//{{AFX - DATA(CAdslNicP)
        enum { IDD = IDD_ADSLNICPROP_DIALOG};
// NOTE: the ClassWizard will add data members here
//}}AFX_DATA
// ClassWizard generated virtual function overrides
//{{AFX_VIRTUAL(CAdslNicP)
        virtual BOOL OnInitDialog();
//} }AFX_VIRTUAL
//Implementation
private:
// These functions are used to modify the registry
        bool GetRegGlobalProfile();
        bool SetRegGlobalProfile();
        BOOL SetBindaryAction();
protected:
// Generated message map functions
//{{AFX_MSG(CAdslNicP)
        afx - msg void OnOk ();
        afx_msg void OnCancelUpdate();
        afx_msg void OnIlmienabled ();
        afx_msg void OnUpdateAtmAddress();
        afx_msg void OnUpdateLinerate();

        afx - msg void OnDisllcsnap();
        afx_msg void OnUni3 I Sig();
        afx_msg void OnUni40Sig();
```



```
              afx_msg void OnPvcMode();
              afx_msg void OnPvpMode();
              afx_msg void OnSelchangeSupportedProts();
       //}}AFX_MSG
              DECLARE_MESSAGE_MAP()};
       Class Constructor - CadslNicP()
```

**[0282]** This is used to construct the standard class for making global setting changes to the ATM/ADSL NIC card. The m_GlobalSettings and mb_SettingsModified member data is initialized in this function. The m_GlobalSettings data are initialized with GetRegGlobalProfile() and mbSettingsModified ia initialized to false.
Return Type:None.
Function Params: None.
Class Destructor - -CAdslNicP()
Description: Standard destructor. No significant change other than standard return is needed for this class. However, if memory is allocated within other class functions and stored within the class member data then that memory needs to be destroyed here!
Return Type:None.
Function Params: None.
Function Override - BOOL OnInitDialog()
Description: Initialization of member data is done here for the UT controls prior to display of the dialog itself. This data resides in the m_GlobalSettings member that was initialized in the creation of this class. Return Type: BOOL. "TRUE" for function success and "FALSE" for failure.
Function Params: None.
Private Function - bool GetRegGlobalProfile()
Description: Used to scan the registry for all of the global ATM interface parameters to establish valid connections (Key value - HKEY_LOCAL_MACHINE\SOFTWARE\Hayes\ServiceMonitor\Interfac e). These parameters are to be stored in m_GlobalSettings member.
Return Type: bool. "True" for function success and "false" for failure.
Function Params: None.
Private Function - bool SetRegGlobalProfile()
Description: Used to update the registry for all of the global ATM interface parameters changed by the user in the UI (Key value - HKEY_LOCAL_MACHINE\
ServiceMonitor/Interface). When changes have been made the member variable "mb - SettingsModified" will be set to true and the changes made by the user will be stored in the m_GlobalSettings member.
Return Type. bool. "True" for function success and "false" for failure.
Function Params: None.
Private Function - BOOL SetBindaryAction()
Description: When changes are made to the global settings, this function is called to initiate a bindery action for the Network Control Panel Applet. This in turn notifies the user that he/she should reboot the system before these new settings can take effect.
Return Type. BOOL. "TRUE" for function success and "FALSE" for failure.
Function Params: None.
Message Mapped Functions - afx - msg void OnOk() and afx_msg void OnCancel()
These functions are used to know when to call SetRegGlobalProfile() and SetBindaryAction(). If the user has made changes to the global settings and he selects OK, then a bindery action takes place before exiting the Network Control Panel Applet. If the user selects Cancel, then all changes are trashed and the applet will exit normally. Both of these functions call their corresponding CDialog::OnOK() and
CDialog::OnCancel() functions prior to returning. If either SetRegGlobalProfile() or SetBindaryAction() functions fail, then the user is notified with a standard dialog warning message box. Some attempt is made to ascertain the nature of the failure. If the OS is NT, the user might not be the Administrator, etc.

**[0283]** All remaining functions are message mapped functions. These functions are used to make changes to the m - GlobalSettings member and set the mb_SettingsModified member if a change was made that is different from the existing value. These functions should rarely fail so there is no need to handle errors within them. The guidelines for the control interaction is described above.

**[0284]** The ServiceMonitor NIC Status and Management Application is the main management and Status application for the NIC Adapter Card.

**[0285]** The Main Application Class (ServiceMonitor.h)is the main application class to start the ServiceMonitor Management and control application. Its purpose is to establish all registered messages, create the main dialog for ServiceMonitor, and establish a mechanism for only allowing a single instance of this application to function.

```
//CServiceMonitorApp:
//See ServiceMonitor.cpp for the implementation of this
class   class CServiceMonitorApp : public CWinApp
public: CServiceMonitorApp(); CDialog *mp_MainDialog;
Overrides .
// ClassWizard generated virtual function overrides
//{{AFX - VIRTUAL(CServiceMonitorApp)
public:
        virtual BOOL lnitlnstance();
        virtual void WinHelp(DWORD dwData, UINT nCmd
HELP_CONTEXT);
//} I AFX_VIRTUAL
        Data static const UINT mcui_ExitWindowsRM;
private:
        bool mb_ClassRegistered;
        Implementation public: BOOL AFXAPI IsHelpKey(LPMSG
IpMsg),
private: bool Firstlnstance();
protected: afx_msg void OnCloseServiceMonitorApp(WPARAM
wParam, LPARAM lParam);
//{{AFX      - MSG(CServiceMonitorApp)
afx_msg      void OnContextHelp();
afx - msg void OnSmHelp();
//}}AFX MSG
DECLARE_MESSAGE_MAP()
Class Constructor - CServiceMonitor()
Description:     Constructs a WinApp application class to
manage the ATM/ADSL NIC Adapter.
```

**[0286]** This also starts the message pump for this application.
Return Type: None.

Function Params: None.
Class Destructor - -CserviceMonitoro
Description: Shuts down any and all processes started by this application and frees any resources being used. Return Type. None.
Function Params: None.
Function Override - BOOL InitInstance()
Description: Creates the main class for this application to allow only a single instance of itself.

**[0287]** Also creates the main window class and the main ServiceMonitor dialog.
Return Type: BOOL.
Function Params: None.
Function Override - void WinHelp(DWORD dwData, UINT nCmd) Description: Directs all help calls to the proper language help files. See WinHelp Windows function description for details on arguments.
Return Type. void.
Function Params: DWORD dwData - Depends on nCmd member. UINT nCmd - Specifies the type of help requested.
Public Function - BOOL AFXAPI IsHelpKey(LPMSG IpMsg) Description: Traps <Shift> F I keyboard commands to call context sensitive help.
Return Type: BOOL AFXAPI.
Function Params: LPMSG IpMsg - Message parameter passed into PreTranslateMessage functions.
Private Function - bool FirstInstance()
Description: Check for a previous instance of this application by searching for a window with our specific pre-registered class name. If one is found, then activate it and return false.
Return Type: bool.
Function Params: None.
Message Mapped Function - afx_msg void OnCloseServiceMonitorApp(WPARAM wParam,
LPARAM lParam)
Description: Called by a registered massaged "SMWRM - SERVICEMONITOR_EXIT_MSG".

**[0288]** This function allows another control application to force ServiceMonitor to shut down and exit.
Return Type: void.
Function Params: WPARAM wParam - Used to pass information for the requested shutdown.
LPARAM lParam - Normally set to 0.
Message Mapped Function - afx_msg void OnContextHelp() Description: Traps all context sensitive help calls to determine when help should be called instead of context help for dialogs.
Return Type. void.
Function Params: None.
Message Mapped Function - afx_msg void OnSmHelp() Description: Used for external calls to ServiceMonitor help.
Return Type: void.
Function Params: None.
Main Dialog Class - CServiceMonitorDlg
(ServiceMonitorDlg.h)

**[0289]** The main ServiceMonitor dialog is created with this class. All threads and application data are initialized in this class to control and manage the ATM/ADSL NIC Adapter. This class or members of this class initiate global performance data and control functions.

```
// ServiceMonitorDlg.h : header file
Copyright (c)1997 Hayes Microcomputer Products, Inc.
class CServiceMonitorDIgAutoProxy;
// CServiceMonitorDlg dialog
class CServiceMonitorDlg: public CDialog
DECLARE      -
DYNAMIC(CServiceMonitorDlg);
friend class     CServiceMonitorDlgAutoProxy;
Construction public: CServiceMonitorDlg(CWnd* pParent -
NULL); standard constructor virtual -CServiceMonitorDlgo;
Data public:
enum
SMD STATUS INIT - 0,
SMD_STATUS_IDLE,
SMD STATUS TR,
SMD STATUS_ENDTR,
SMD STATUS_ERRTR,
SMD STATUS_RX,
SMD STATUS_ENDRX,
SMD_STATUS_ERRRX,
SMD STATUS MODDISCONNECT,
SMD_STATUS_ERROR
enum SMWM SHELLNOTIFYICON -(WM_APP+100), SMWM
GETGLOBALPROTOCOL, SMWM CHANGEGLOBALPROTOCOL, SMWM SCM
DISPLAYDLG, SMWM SCM MONITORPROPS. SMWM SCM INSTNEWSERV,
SMWM SCM CONNDISCONN // Used for internal updates
CServiceMonitorProfile mp_SMSessionProfile; CBitmap mbc -
ServConnStatActive; CBitmap mbc_ServConnStatInactive;
CBitmap mbc_ServConnStatError;
```

```
Private:
        NOTIFYICONDATA m_SMD_NotifyIconId; // This is the
System Tray Icon
Information
        CString msc_SMD - NotifylconStatus;// Tip string
data for STI.
        CWinApp *mp_ServiceMonitorApp;
        HACCEL mhac_Global;
        HICON mhi - Main;
        double md_ConnectionTime;
// Total modem connection time.
        double md - TransmittedAmount;
Total modem transmitted quantity.
        double md ReceivedAmount;
Total modem received quantity.
        boot mb ADSLModemIsConnected;
        boot mb ShellRMDblClick;
        boot mb IsAccelHelp;
        boot mb_DialogShel I Icon;
Dialog Data
        //{ {AFX I DATA(CServiceMonitorDlg)
        enum IDD - IDD_SERVICEMONITOR_DIALOG
NOTE: the ClassWizard will add data members here
//}}AFX_DATA
// ClassWizard generated virtual function overrides
//{{AFX_VIRTUAL(CServiceMonitorDlg) public: virtual BOOL
PreTranslateMessage(MSG* pMsg); protected: virtual void
DoDataExchange(CDataExchange* pDX);// DDX/DDV support
virtual void PostNcDestroy(); //}}AFX_VIRTUAL
Implementation public: boo] ShowServiceProperties(UINT
startPage); void OnDisplayServiceMonitorDlg();
```

```
// ADSL Modem Functions void ModemConnDisconn(); boot
ModemConnect(); boot ModemDisconnect();
// System Tray Related Functions
void ModifyTrayIcon(UINT SMD - Status, UINT connectTime,
UINT
TXAmount,    UINT RXAmount);
// Service Related Functions
       bool IsATMConnActive(DWORD atmVC);
private:
// This class knows when to create and destoy the shell
icon!
        void DeleteTrayIcon();
        void CreateTraylcon();
protected:
       CserviceMonitorDlgAutoProxy* m_pAutoProxy;
       BOOL CanExit();
// Generated message map functions
//{{AFX - MSG(CServiceMonitorDlg)
       virtual BOOL OnInitDialog();
       afx_msg void OnSysCommand(UINT nID, LPARAM
lParam);
       afx_msg void OnDestroy();
       afx_msg void OnPaint();
       afx_msg HCURSOR OnQueryDragIcon();
       afx_msg void OnClose();
       virtual void OnOK();
       virtual void OnCancel();
       afx_msg void OnDisconnectModem();
       afx_msg void OnServiceProperties();
       afx_msg BOOL OnHelplnfo(HELPINFO* pHelplnfo);
//}}AFX - MSG
```

```
// User Defined Message Functions - These have to be
manually updated!
        afx_msg LRESULT OnTrayCommNotification(WPARAM
wParam,LPARAM
              lParam);
        afx_msg LRESULT OnTrayShellNotification(WPARAM
wParam,LPARAM
              lParam);
        DECLARE_MESSAGE_MAP()
};
ServiceMonitor Properties Class - CServiceMonitorPS
(ServiceMonitorPS.h)
 <Insert Description here!!!!>
////////////////////////////////////////////////////////////
////////////////////
//
ServiceMonitorPS.h : header file
//
Copyright (c)1997 Hayes Microcomputer Products, Inc.
//
////////////////////////////////////////////////////////////
//////////////////
////////////////////////////////////////////////////////////
//////////////////

//CserviceMonitorPS
class CServiceMonitorPS : public CpropertySheet
{
        DECLARE_DYNAMIC(CServiceMonitorPS)
//Construction
public:
        CserviceMonitorPS(UINT nlDCaption, CWnd*
pParentWnd NULL, UINT iSelectPage         0);
        CserviceMonitorPS(LPCTSTR pszCaption, CWnd*
pParentWnd = NULL, UINT         iSelectPae = 0);
        virtual -CScrviceMonitorPS0;
// Attributes
public:
        //.These are the tabs for the property sheet.
        CservicesPage            m_PSTI -Services;
        CATMInterfacePage        m_PST2ATMInterface;
        CoptionsPage             m_PST3_Options;
        CmodemParamPage          m_PST5_ModemParam;
        CmodemCountersPage       m_PST6_ModemCounters;

private:
// Our parent window and some data on it.
        Cwnd *mwcp_Parent;
        long ml_XCoordinate;
        long ml_YCoordinate;
// Our main App class and any accelerator tables needed.
        HACCEL mhac_Global;
        CwinApp *mp_ServiceMonitorApp;
        bool mb_IsAccelHelp;
//Operations
private:
         void InitializePSTabs();
//Overrides
// ClassWizard generated virtual function overrides
        //{{AFX_VIRTUAL(CServiceMonitorPS)
        public:
        virtual BOOL OnInitDialog();
        virtual BOOL PreTranslateMessage(MSG* pMsg);
```

```
 //}}AFX_VIRTUAL
 //Implementation
 protected:
 // Generated message map functions
 //{ {AFX I MSG(CServiceMonitorPS)
        afx_msg BOOL OnHelpInfo(HELPINFO* pHelpInfo);
 //}}AFX - MSG
 // User Defined Message Functions - These have to be
manually updated!
        afx_ msg LRESULT OnGetGlobalProtocol(WPARAM
m_wParam,LPARAM   m_lParam);
        afx_msg LRESULT OnChangeGlobalProtocol(WPARAM
m_wParam,LPARAM
        m_lParam);
        DECLARE_MESSAGE_MAP()
};
```

Data Profile Class - CServiceMonitorProfile (ServiceMonitorProfile.h)

<Insert Description here!!!>

```
/////////////////////////////////////////////////////////
///////////////
//
//ServiceMonitorProfile.h : header file
//
//Copyright (c)1997 Hayes Microcomputer Products, Inc.
//
/////////////////////////////////////////////////////////
////////////////
```

ReNew(c,p,t): c = New size you want; p = pointer to memory loc.; t = type of storage you want; #define ReNew(p,c,t) (t *)SMPReNew( (p), ((c)*sizeof(t)) )

```
// Registry String values for Global settings (Main &
Interface keys)
#define SMGS_MK_POST                    *Post"
#define SMGS_MK_USEGBLPROF              "UseGlobalProfile"
#define SMGS_MK_DISPADSLSTATS
"DisplayADSLStats"
#define SMGS_IK_ILMIATMADD              "ILMIATMAddress"
#define SMGS_IK_ILMIENABLED                 "ILMIEnabled"
#define SMGS_IK_OAMF4ENABLED                "OAMF4"
#define SMGS_IK_OAMF5ENABLED                "OAMF5"
#define SMGS_IK_PROTSSUPPORTED          "ProtSupport"
#define SMGS_IK_SIGNALING               "Signaling"
#define SMGS_IK_USERATMADD              "UserATMAddress"
#define SMGS_IK_PVPMODE                     "PVPMode"
#define SMGS_IK_GUARLINERATE                "GuarLineRate"
#define SMGS_IK_LLCSNAPENABLED          "LLCSNAPEnable"

// Registry String values for Service Profile data
#define SMPS_ISK_SERVCOUNT              "Count"
#define SMPS_VCIVPI                         "Connection"
#define SMPS_CLASS_PROT                     "ConnectionC&I"
#define SMPS_REGNAME                    "RegServiceName"
#define SMPS_CLS_SCRPEAK                    "SCRPeak"
#define SMPS_CLS_SCRMINIMUM                 "SCRMinimum"
#define SMPS_CLS_SCRBURSTTOL                "SCRBurstTol"
#define SMPS_CLS_SCRSUSTAINABLE         "SCKSustainable"
#define SMPS_IPOA_SVCPVCCONN
"ConnectionType"
#define SMPS_IPOA_ARPSRVADD                 "ARPSrvAddress"
#define SMPS_IPOA_ARPSRVIPADD
"ARPSrvIPAddress*
#define SMPS_IPOA_IPSUBNET              "Subnet"
```

```
#define SMPS_IPOA_IPSUBNETMASK        "SubnetMask"
#define SMPS_IPOA_IPREMOTE            "Remote"
#define SMPS_IPOA_IPLOCAL             "Local"
#define SMPS_IPOA_USEDEFGATEWAY       "UseDefGateway"
#define SMPS_FLANE_USEWKLECSADD
"UWKLECSAddEnabled"
#define SMPS_FLANE_LECSADD            "LECSAddress"
#define SMPS_FLANE_LESADD             "LESAddress"

// Function Return ERROR codes
#define INVALID_SERVLIST_NUMBER  0xffffffff
#define INVALID_ATMVC_NUMBER          0xffffffff
#define INVALID_POINTER               0xfffffffe
#define FUNC_SUCCESS             0x00000001
#define CLASS_UNINITIALIZED           0xffffffff

// Update Global Settings Mask Values
#define SMGS_MKMSK_UDATMINTERFACE     0x0001
#define SMGS_MKMSK_UDOPTIONS          0x0002
#define SMGS_MKMSK_UDALL
(SMGS_MKMSK_UDATMINTERFACE
               SMGS_MKMSK_UDOPTIONS)

// Max and Min values for various ATM/ADSL data
#define MAX_VCI_VALUE                 4096
#define MIN_VCI_VALUE                 32
#define MAX_VPI_VALUE                 255
#define MIN_VPI_VALUE                 0

// ATM Class Stings
#define STR_ATMCLASS_CBR              "CBR"
#define STR_ATMCLASS_UBR              "UBR"
```

```
#define STR_ATMCLASS_UBRP         "UBR+"
#define STR_ATMCLASS_VBR               "VBR"

// Protocol Strings
#define STR_PROT_NATM             “Native ATM"
#define STR_PROT_IPOA             "IP over ATM"
#define STR_PROT_FLANE                 "Forum LANE"
#define STR_PROT_PPPOA                 "PPP over ATM"
#define STR_PROT_IPXOA                 "IPX over ATM"
#define STR_PROT_NETBOA                "NetBEUI over ATM"

// Signaling Types and Strings
#define SMGS_IK_SIGVALUN131                 0x00000000
#define SMGS_IK_SIGVALLN140                 0x00000001
#define STR_UN131                           "UNI 3.1"
#define STR_UN140                           "UNI 4.0"

// Misc. Strings
#define STR_NOATMADDR             “(*Not Used with ILMI
Enabled*)”
#define STR_ENABLED                    "Enabled"

#define STR_DISABLED              "Disabled"
#define STR_PVPMODE                    "PVP"
#define STR_PVCMODE               "PVC"
// Exported Misc. Functions
extern unsigned long convertStringToULong(LPSTR pString);
extern void removeTLWSpace(LPSTR pString),
extern DWORD GetWinOSVersion(UINT *majorVer, UINT
*minorVer);
// Exported Inline Functions
extern inline void removeAllWSpace(LPSTR pString);
```

```
/////////////////////////////////////////////////////////
/////////////////////
CServiceMonitorProfile object
class CServiceMonitorProfile : public CObject
{
        DECLARE_DYNCREATE(CServiceMonitorProfile)
//Construction
public:
        CserviceMonitorProfile();
        virtual -CServiceMonitorProfile();
//Attributes
public:
        enum{
             SMP_ATMCLS_CBR - 0,
             SMP_ATMCLS_UBRP,
             SMP_ATMCLS_UBR,
             SMP_ATMCLS_VBR
        }SMP_ATMClassTypes;

enum {
        SNMP_STRING = 0,    //Standard SNMP style Response
        SNMP_INTEGER,     //The rest is my custome ones
        SNMP_UNI_STATUS,
        SNMP_GET_MACADDRESS,
        SNMP_GET_UPTIME,
        SNMP_GET_IPADDRESS,
        SNMP_GET_ATMADDRESS,
        SNMP_GET_LECSTATUS
        }SNMP_NIC_Calls;

protected:
        SMDChannelStatusLstLP        mp_ChnlStatusList;
        SMDVirtualConnStatLstLP       mp_VCStatusList;
        SMDServiccDataListLP          nip_lnstServList;
        SMDGlobalATMSettingsLP        mp_GbIATMSettings;
        LPVOID                        mvp_NicManager;
private:
        char mcs_HRegKey[50];
        char mcs_HISRegKey[20];
        char mcs_HGblSetRegKey[10];
        char mcs_HGlbATMRegKey[15];
        boo] mb_UseGlobal Profile;
        bool mb_IsUserProfileAdmin;
        DWORD mdw_TotalNoInstServs;
//Operations
public:
// Global ATM/ADSL Functions that interact with
m_GblATMSettingsPtr data member!
        bool IsADSLStatRequested();
        bool GetGbIRegProfile(SMDGlobalATMSettingsLP
pGbIProfile -NULL);
        bool UpdateGblRegProfile(SMDGlobalATMSettingsLP
pGblProfile -NULL, UINT                       udMask =
SMGS_MKMSK_UDALL);
        UINT GetGblProtSetting();
        UINT GetSignalingType();
        DWORD    GetMaxUpStreamBW();
        UINT GetAtmAddress(char *bufAtmAddr, int
szBuffer);
        bool IsILMIEnabled();
        bool IsLLC - SNAPEnabled();
        bool lsModePVP();
// VC Functions that interact with m_VCStatusListPtr data
member!
```

```
       BOOL      IsATMVCActive(DWORD atmVC);
       BOOL      IsATMVCActive(int lstNo);
       Service Functions that interact with m
lnstServListPtr data member!
       DWORD GetAtmVCFromList(int list = 0); // One based
List
       bool GetServUserName(DWORD atmVC = 0, LPSTR
pStrBuffer = NULL, DWORD bufSz= 0);
       bool GetServUserName(int listNo = 1, LPSTR
pStrBuffer = NULL, DWORD bufSz = 0);
       bool GetServRegName(DWORD atmVC = 0, LPSTR
pStrBuffer = NULL, DWORD bufSz =0);
       bool GetServRegName(int listNo = 1, LPSTR
pStrBuffer = NULL, DWORD bufSz = 0);
       DWORD GetInstSrvCount();
       DWORD GetSrvDataProfile(DWORD atmVC=- 0,
SMDServiceDataLP pSrvProfile = NULL);
       bool AddNewRegService(SMDServiceDataLP pSrvProfile
=NULL);
       bool RemoveRegService(LPSTR pUserSrvName = NULL);
       bool UpdateRegService(LPSTR pCurSrvName = NULL,
SMDServiceDataLP pSrvProfile= NULL);
       bool UpdateRegService(int IstNo = 0,
SMDServiceDataLP pSrvProfile = NULL);
       bool UpdateRegService(DWORD atmVC = 0.
SMDServiceDataLP pSrvProfile= NULL);
       void DestroySrvRegList(SMDServiceDataListLP
*pSrvRegLst);

       // Protocol Related Functions
       bool GetNewProtDataStruct(void **dpProtData, UINT
protType);
```

```
        //Misc. Functions
private:
        bool InitializeNew(); // Standard true succeds and
false fails
        // General Functions
        // Memory Related functions
        void *SMPReNew(void *memHandle, DWORD newSize);
        void SMPFreeReNew(void *memHandle);

// Global ATM/ADSL functions
         bool InitGblRegProfile();

// Service related functions
        bool InitSrvRegValues(char *serviceKeyName,
SMDServiceDataLP pService);
        int  InitSrvRegList();
        bool     UpdateSrvRegList();
        void      DestroylntSrvRegList();

        SMDServiceDataLP GetServDataFromLstNo(int lstNo);
        // Service functions for connection performance &
status
         bool CreateConnLstFromSrvLst();
//Overrides
// ClassWizard generated virtual function overrides
//{{AFX_VIRTUAL(CServiceMonitorProfile)
//}}AFX_VIRTUAL
// Implementation
         protected:
};
```

Install Services Class - CServicesPage (ServicesPage.h)

<Insert Description here!!!!>

```
////////////////////////////////////////////////////////////
/////////////////
        //
        ServicesPage.h : header file

        //

        Copyright (c)1997 Hayes Microcomputer Products,
Inc.

        //

        /////////////////////////////////////////////////////
////////////////////////

        /////////////////////////////////////////////////////
///////////////////////

        //CservicesPage dialog

        class CServicesPage : public CPropertyPage
        {
             DECLARE_DYNCREATE(CServicesPage)

        //Construction
        public:
             CservicesPage();
              virtual ~CServicesPage();

        //Dialog Data
             // {{ AFX_DATA(CServicesPage)
             enum { IDD = IDD SERVICESPAGE};
```

```
                    //NOTE - ClassWizard will add data
members here.
                    //DO NOT EDIT what you see in these
blocks of generated code!
               //}}AFX_DATA

       private:
       //   CBitmap m_ServConnStatActive;
       //   CBitmap m_ServConnStatInactive;
       //   CBitmap m_ServConnStatError;
            CimageList m_ServConnStatImage;
            CgraphBar m_PerfGraph;
            TC_ITEM m_TabData;
            bool mb_TabControllnitialized;
            bool mb_SettingsModified;
            void *mvp_ServList;
            void *mvp_ProtList;
            void *mvp_ModServList;

// Overrides
//ClassWizard generate virtual function overrides
//{ {AFX - VIRTUAL(CServicesPage)
            public:
            virtual BOOL OnSetActive();
            virtual BOOL OnApply();
            protected:
            virtual void DoDataExchange(CDataExchange*
pDX);   //DDX/DDV support
//}}AFX_VIRTUAL
//Implementation
       private:
              void AddServToModList(int IistNo, DWORD
pvServData);
          protected:
//Generated message map functions
//{ {AFX_MSG(CServicesPage)
          afx_msg BOOL OnHelpInfo(HELPINFO* pHelpInfo);
          afx_msg void OnServInstallnew();
          afx_msg void OnServProperties();
          afx_msg void OnServStopstart();
          afx_msg void OnServUninstall();
          virtual BOOL OnInitDialog();
          afx_msg void OnSelChangeInstalledServ(NMHDR*
pNMHDR, LRESULT* pResult);
//}}AFX_MSG
          DECLARE_MESSAGE_MAP()
```

Service Properties Class - CServiceProperties (ServiceProperties.h)

<Insert Description here!!!>

```
          //////////////////////////////////////////////////
//////////////////////////
          //
          //ServiceProperties.h : header rile
          //
          //Copyright (c)1997 Hayes Microcomputer Products,
Inc.
          //
          //////////////////////////////////////////////////
/////////////////////////
          //////////////////////////////////////////////////
/////////////////////////
//CserviceProperties dialog
```

```
       class CServiceProperties: public Cdialog
       {
 // Construction
       public:
            CserviceProperties(CWnd* pParent = NULL); //
standard constructor
//Dialog Data
//{{ AFX_DATA(CServiceProperties)
            enum {IDD = IDD SERVICEPROPERTIES};
//NOTE: the ClassWizard "I add data members here
//}}AFX_DATA
       private:
// Our main App class and any accelerator tables needed.
       HACCEL mhac_Global;
       CwinApp *mp_ServiceMonitorApp;
       bool mb - IsAccelHelp;
       void *mvp_ServiceData;
       char mcs - DIgTitle[256];
       UINT     mui_GblProtUsed;
//Overrides
// ClassWizard generated virtual function overrides
//{ {AFX - VIRTUAL(CServiceProperties)
            public:
            virtual BOOL PreTranslateMessage(MSG* pMsg);
            protected:
            virtual void DoDataExchange(CDataExchange*
pDX);  DDX/DDV support
//}}AFX_VIRTUAL
// Implementation
       public:
            void SetServiceDataPtr(void *pSrvData =
NULL);
```

```
            void SetGbIProtType(UINT gblProtUsed);
        protected:
            //Generated message map functions
            //{ {AFX_MSG(CServiceProperties)
            afx_msg void OnModify();
            afx - msg BOOL OnHelplnfo(HELPiNFO*
pHelplnfo);
            virtual BOOL OnlnitDialog();
            afx_msg void OnNoModify();
            //}}AFX_MSG
            DECLARE_MESSAGE_MAP()
        };
```

Modify Service Class - CModifyService (ModifyService.h)
<Insert Description here!!!!>

```
        ////////////////////////////////////////////////////
//////////////
        //
        //ModifyService.h : header file
        //
        //Copyright (c)1997 Hayes Microcomputer Products,
Inc.
        ////////////////////////////////////////////////////
///////////////
        ////////////////////////////////////////////////////
///////////////
        // CModifyService dialog
         class CModifyService: public Cdialog
        {
        //Construction
        public:
             CmodifyService(CWnd* pParent = NULL); //
standard constructor       -CmodifyServiceo;
       // Dialog Data
             //{{AFX_DATA(CModifyService)
             enum { IDD = IDD_MODIFY_SERVICE);
                  // NOTE: the ClassWizard will add data
members here
             //}}AFX_DATA
             void *mvp_ServiceProtData;

             UINT      mui_GbIProtUsed;

       private:

             // Our main App class and any accelerator
tables needed.
             HACCEL mhac_Global;
             CwinApp *mp_ServiceMonitorApp;
             bool mb_IsAccelHelp;
             bool mb_DlgInitialized;
             void *mvp_ServiceData;
             char mcs_DlgTitle[256];
             bool mb_DataModified;
             bool mb_ProtModified;
       // Overrides
             // ClassWizard generated virtual function
overrides
             //{{AFX_VIRTUAL(CModifyService)
             public:
             virtual BOOL PreTranslateMessage(MSG* pMsg);
             protected:
```

```
          virtual void DoDataExchange(CDataExchange*
pDX); // DDX/DDV support
          //}}AFX_VIRTUAL
      Implementation
      public:
          void SetServiceDataPtr( void *pSrvData =
NULL);
          void SetGbIProtType(UINT gblProtUsed);
      private:
          void SetSCRWndsForClass(int atmClass),
      protected:
          // Generated message map functions
          //{{AFX_MSG(CModifyService)
          afx_msg BOOL OnHelpInfo(HELPINFO* pHelpInfo);
          afx_msg void OnCiSettings();
          afx_msg void OnModCancel();
          afx_msg void OnModOk();
          virtual BOOL OnlnitDialog();
          afx_msg void OnSelchangeServiceAtmclass();
          afx_msg void OnKillfocusServiceVci();
          afx_msg void OnKillfocusServiceVpi();
          afx_msg void OnUpdateServiceVpi();
          afx_msg void OnUpdateServiceVci();
          afx_msg void OnUpdateEditControls();
          afx_msg void OnSelchangeServProtocol();
          afx_msg void OnServconnPvc();
          afx_msg void OnServconnSvc();
          //}}AFX_MSG
          DECLARE_MESSAGE_MAP()
      };
```

IP over ATM Protocol Settings Class - CATMIIPSettings (ATMIIPSettings.h)

<Insert Description here!!!!>

```
        ///////////////////////////////////////////////////
//////////////
        //
        // ATMIIPSettings.h : header file
        //
        // Copyright (c)1997 Hayes Microcomputer
Products, Inc.
        //
        ///////////////////////////////////////////////////
////////////
        ///////////////////////////////////////////////////
///////////
        //CATMIIPSettings dialog

        class CATMIIPSettings: public Cdialog
        {
         // Construction
        public:
             CATMIIPSettings(CWnd* pParent -NULL); //
standard constructor
        //Dialog Data
             //{{AFX_DATA(CATMIIPSettings)
             enum { IDD = IDD_ATMI_IPSET };
                  // NOTE: the ClassWizard will add data
members here
             //}}AFX_DATA

        private:
                // Our main App class and any accelerator
   tables needed.
                HACCEL mhac_Global;
                CwinApp, *mp_ServiceMonitorApp;
                bool mb_IsAccelHelp;
                bool mb ProtDataModified;
                bool mb_Dlglnitialized;
                bool mb_ConnIsSvc;
                void *mvp_ProtData;

         //Overrides
                // ClassWizard generated virtual function
   overrides
                //{{AFX_VIRTUAL(CATMIIPSettings)
                public:
                virtual BOOL PreTranslateMessage(MSG* pMsg);
                protected:
                virtual void DoDataExchange(CDataExchange*
   pDX);   DDX/DDV support
                //}}AFX_VIRTUAL

         //Implementation
          public:
                void SetProtDataPtr(void *pServData);
                inline void SetSrvConnType(bool bConnlsSvc =
   false) {mb_ConnIsSvc
   bConnIsSvc;};
         protected:
                // Generated message map functions
                //{{AFX_MSG(CATMIIPSettings)
                afx_msg BOOL OnHelpInfo(HELPINFO* pHelpInfo);
                afx_msg void OnIPOACancel();
                afx_msg void OnIPOAOk();
                virtual BOOL OnlnitDialog();
                afx_msg void OnPvclpcon();
                afx_msg void OnSvclpcon();
                afx_msg void OnUsedefgateway();
                afx_msg void OnUpdateArpsrvAtmadd(),
                afx_msg void OnUpdateArpsrvIpadd();
                afx_msg void OnUpdateLipsIpadd();
                afx_msg void OnUpdateRipslpadd();
                //} }AFX_MSG
                DECLARE_MESSAGE_MAP()
            };
```

ATM Interface Settings Class - CATMInterfacePage (ATMInterfacePage.h)

<Insert Description here!!!>

```
       //////////////////////////////////////////////////
////////////
       //
       //ATMInterfacePage.h : header file
       //
       //Copyright (c)1997 Hayes Microcomputer Products,
Inc.
       //
       //////////////////////////////////////////////////
///////////
       //CATMInterfacePage

       class CATMInterfacePage : public CpropertyPage
       {
            DECLARE_DYNCREATE(CATMInterfacePage)
       //Construction
```

```
        public:
             CATMInterfacePage();
             virtual -CATMinterfacePage();
        //Dialog Data
         private:
             CgraphBar m_PerfGraph;
             //{{ AFX_DATA(CATMInterfacePage)
             enum IDD =IDD_ATMINTERFACEPAGE};
                  //NOTE - ClassWizard will add data
members hem.
                  // DO NOT EDIT what you see in these
blocks of generated code!
             //}}AFX_DATA

        //Overrides
             // ClassWizard generated virtual function
overrides
             //{{AFX - VIRTUAL(CATMInterfacePage)
             protected:
             virtual void DoDataExchange(CDataExchange*
pDX);   DDX/DDV support
             //}}AFX_VIRTUAL
        //Implementation
        public:
             UINT GetGlobalProtSetting();
             // Generated message map functions
        protected:
             //{{AFX I MSG(CATMInterfacePage)
             afx_msg BOOL OnHelpInfo(HELPINFO* pHelpInfo);
             virtual BOOL OnInitDialog();
             //}}AFX - MSG
             DECLARE_MESSAGE_MAP()
```

User Options Class - COptionsPage (OptionsPage.h)

<Insert Description here!!!!>

```
/////////////////////////////////////////////////////////
       //
       //OptionsPage.h : header file
       //
       //Copyright (c)1997 Hayes Microcomputer Products,
Inc.

/////////////////////////////////////////////////////////

/////////////////////////////////////////////////////////
       //CoptionsPage dialog
       class COptionsPage : public CpropertyPage
       {
             DECLARE_DYNCREATE(COptionsPage)
       //Construction
        public:
            CoptionsPage();
            virtual -COptionsPage();
       //Dialog Data
            //{{AFX_DATA(COptionsPage)
            enum {IDD =IDD_OPTIONSPAGE};
                 //NOTE - ClassWizard will add data
members here.
                 //DO NOT EDIT what you see in these
blocks of generated
                 code!
            //}AFX_DATA
       private:
            void *mvp_GlobalSettings;
            bool mb_DIgInitialized,
            bool mb_SettingsModified;

        //Overrides
             // ClassWizard generate virtual function
overrides         //{{AFX_VIRTUAL(COptionsPage)
            public:
            virtual BOOL OnApply();
            protected:
            virtual void DoDataExchange(CDataExchange*
pDX); // DDX/DDV support
            //{{AFX_VIRTUAL

            // Implementation
            protected:
                 // Generated message map functions
                 //{{AFX_MSG(COptionsPage)
                 virtual BOOL OnInitDialog();
                 afx_msg void OnDispadsImodtab();
                 afx_msg void OnPowerOnselftest();
                 //} }AFX_MSG
                 DECLARE_MESSAGE_MAP()
        };
```

ADSL Modem Parameters Class - CModemParamPage (ModemParamPage.h)

<Insert Description here!!!>

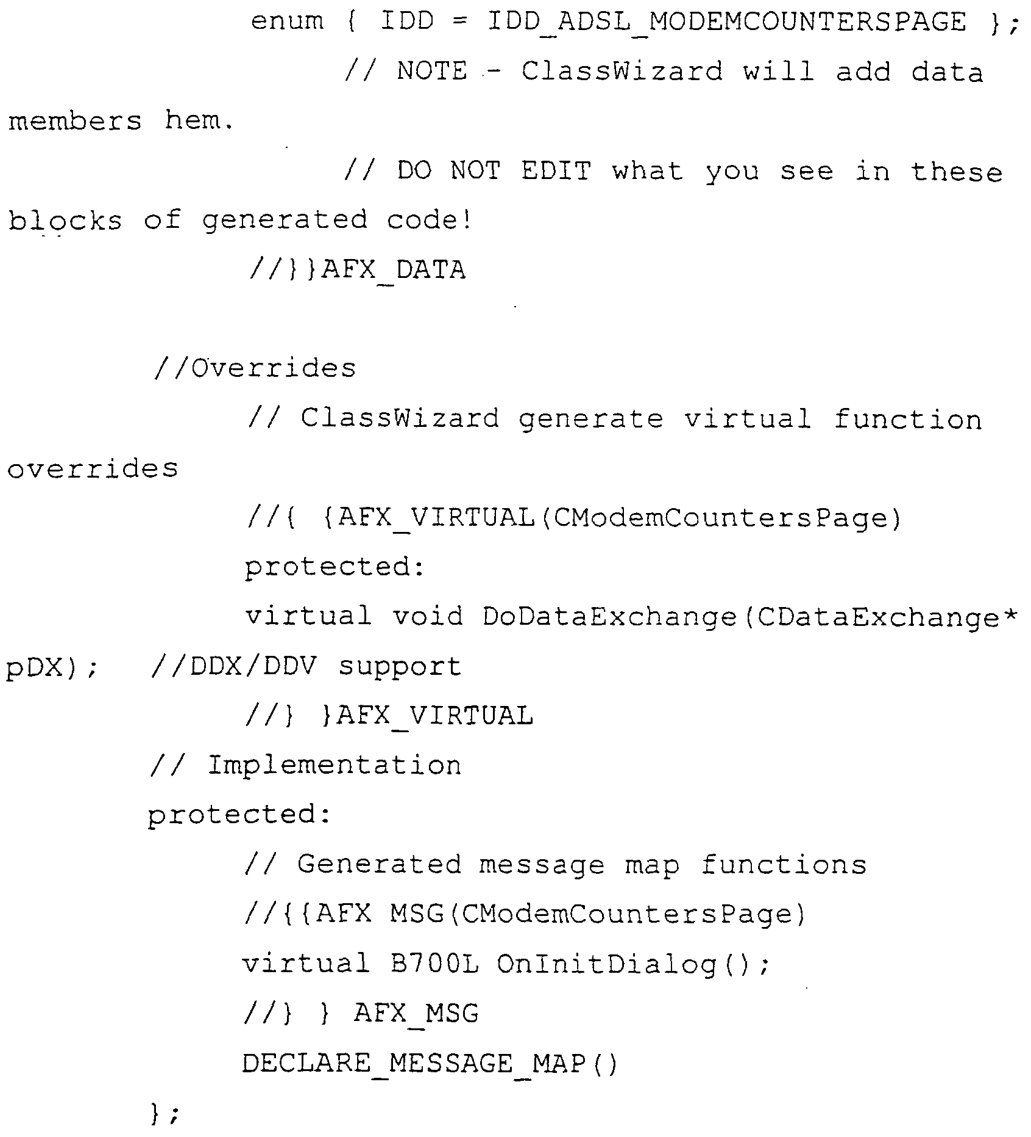
```
        ///////////////////////////////////////////////////
///////////
        //
        //ModemParamPage.h : header file
        //
        // Copyright (c)1997 Hayes Microcomputer Products,
Inc.
        //
        ///////////////////////////////////////////////////
////////////
        ///////////////////////////////////////////////////
///////////
        //CmodemParamPage dialog
        class CModemParamPage: public CpropertyPage
        {
              DECLARE_DYNCREATE(CModemParamPage)
        //Construction
         public:
             CmodemParamPage();
             virtual -CModemParamPage();

        // Dialog Data
             //{{AFX_DATA(CModemParamPage)
             enum IDD = IDD_ADSL_MODEMPARAMPAGE};
                  //NOTE - ClassWizard will add data
members here.
                  //DO NOT EDIT what you see in these
blocks of generated code!
             //}}AFX_DATA

        //Overrides
             // ClassWizard generate virtual function
overrides
             //{{AFX VIRTUAL(CModemParamPage)
             protected:
             virtual void DoDataExchange(CDataExchange*
pDX); // DDX/DDV support        //}}AFX_VIRTUAL
```

```
        // Implementation
         protected:
            // Generated message map functions
            //{{AFX_MSG(CModemParamPage)
            virtual BOOL OnlnitDialog();
            //}}AFX_MSG
            DECLARE_MESSAGE_MAP()
        };
```

ADSL Modem Counters Class - CModemCountersPage (ModemCountersPage.h)

<Insert Description here!!!>

```
///////////////////////////////////////////////////////////
        //
        //ModemCountersPage.h : header file
        //
        //Copyright (c)1997 Hayes Microcomputer Products,
Inc.
        ////////////////////////////////////////////////////
/////////
        ////////////////////////////////////////////////////
////////
        //CmodemCountersPage dialog
         class CModemCountersPage : public CpropertyPage
        {
            DECLARE_DYNCREATE(CModemCountersPage)
        //Construction
         public:
            CmodemCountersPage();
            virtual -CModeniCountei-sPage();
        //Dialog Data
            // {  {AFX_DATA(CModemCountersPage)
```



```
                enum { IDD = IDD_ADSL_MODEMCOUNTERSPAGE };
                     // NOTE - ClassWizard will add data
members hem.
                     // DO NOT EDIT what you see in these
blocks of generated code!
                //}}AFX_DATA

        //Overrides
                // ClassWizard generate virtual function
overrides
                //{ {AFX_VIRTUAL(CModemCountersPage)
                protected:
                virtual void DoDataExchange(CDataExchange*
pDX);   //DDX/DDV support
                //} }AFX_VIRTUAL
        // Implementation
        protected:
                // Generated message map functions
                //{{AFX MSG(CModemCountersPage)
                virtual B700L OnInitDialog();
                //} } AFX_MSG
                DECLARE_MESSAGE_MAP()
        };
```

Performance Graph Class - CGraphBar (GraphBar.h)

**[0290]** This class object is an owner drawn graph control that subclasses a static window passed in. This control object creates a bitmap graph and displays a ten second history of performance data for three ATM parameters (Transmit, Received, and Discarded cells). A single object instance can maintain data for multiple connections and display a graph for any single connection upon request.

```
//////////////////////////////////////////////////////////
////
       //
       //GraphBar.h : header file
       //
       // Copyright (c)1997 Hayes Microcomputer Products,
Inc.
       //
       ///////////////////////////////////////////////////
///////////
       #define MAX_IN_LIST       14
       #define MAX_VERTICAL           26
       #define MAX_HORIZONTAL MAX_IN_LIST
       ///////////////////////////////////////////////////
///////////
       //CgraphBar window

       class CGraphBar: public CWnd
       {
        // Construction
       public:
            CgraphBar();

       //Attributes
       public:



       private:
             unsigned long mui_TotalSoFar;
            Cwnd       *mp_WindowHandle;
            int          mi_List[MAX_IN_LIST];
            int          mi_BarYPos[MAX_VERTICAL];
            int          mi_BarXPos[MAX_HORIZONTAL];
            int          mi_StartMarker;
            RECT         m_FillRect;
            Cbitmap      mbc_Graph;
            Cbitmap     *mbcp_OldGraph;
            CDC           *mdccp_Rastering;
       //Operations
        public:
             bool SetGraphParentWnd(CWnd *pParentWnd);

            bool SetGraphParentWnd(HWND hParentWnd);
            bool SetGraphParentWndToDlgItem(UINT nID,
CWnd* pParentWnd);
            void AddNewValue(int value);

       //Overrides
             // ClassWizard generated virtual function
overrides    '     //{{AFX_VIRTUAL(CGraphBar)
            //} }AFX_VIRTUAL

       // Implementation
       public:
            virtual -CGmphBaro;

       private:
            void DoBarDrawing();
            // Generated message map functions
       protected:
            //{{AFX I MSG(CGraphBar)
            afx_msg BOOL OnEraseBkgnd(CDC* pDC);
            afx_msg void OnPaint();
            //I } AFX_MSG
```

```
                DECLARE_MESSAGE_MAP()
        };
```

Common Data for all Class Objects (ServiceMonitorData.h)
<Insert Description here!!!>

```
/****************************************************
        **
        **ServiceMonitorData.h: Data header file for
retrieving status
        **    information from the ATM/ADSL Modern card.
This header is
        **    designed for a C interface and not C++.
        **
        **Copyright (c)1997 Hayes Microcomputer Products,
Inc.
        **

****************************************************

        #if!defined(SERVICEMONITORDATA_H)

        #define SERVICEMONITORDATA_H    1I

        /*

        **Protocols supported by this ATM/ADSL NIC/Modem
card
        /*
        #define HAYES_ATMADSLPROT_NATM          0x00001
        #define HAYES_ATMADSLPROT_IPOA
0x00002
```

```
        #define HAYES_ATMADSLPROT_FLANE         0x00004
        #define HAYES_ATMADSLPROT_PPPOA         0x00008
        #define HAYES_ATMADSLPROT_IPXOA         0x00016
        #define HAYES_ATMADSLPROT_NETBOA        0x00032

        /*
        **Max values for data types.
        /*
        #define HAYES_MAX_SERVUSERNAME     16
        #define HAYES_MAX_SERVREGNAME      51
        #define HAYES_MAX_IPADDRESS        16
        #define HAYES_MAX_ATMADDRESS       60
        #define HAYES_MAX_CARRIERLOAD      128
        #define HAYES_MAX_NUMBERSERVS      4096
        /*
        **Event handle names for processing IO request
        */
        #define READIO_THREAD_EVENT_NAME
"SM_READIO_EVENT"
        #define READ_THREAD_EVENT_NAME
"SM_READ_EVENT"
        #define WRITE_THREAD_EVENT_NAME
"SM_WRITE_EVENT"

        #if defined(_CPLUSPLUS) 11 defined(C_PLUSPLUS)
         extern "C"{
         #endif
        /*
        **Signaling types supported by this ATM/ADSL
NIC/Modem card
        */
        typedef enum {
              DUSUNI31 = 0,
              DUSUN140
        }DialupSignaling;
        typedef enum {
              VCSTATUS_ACTIVE =0,
              VCSTATUS_INACTIVE,
              VCSTATUS_DISABLED
        } VirtualConnStatus;
        typedef struct_dualEndUDS{
              long upstream
              long downStream;
        }DualEndUDS;
        typedef struct_dualEndMR{
               long adslModem;
              long remoteEnd;
        } DualEndMR;
        /*
        **    ATM/ADSL Modem Current Operational Line
Parameters

        */

        typedef struct _smdOpParams{
              DualEndMR       attenuation;
              DualEndMR       noiseMargin;
              DualEndMR outputPower,
              DualEndMR relCapOcc;
              DualEndMR maxAttBW;
              DualEndMR actualBitRate;
              char carrierLoad[HAYES_MAX_CARRIERLOAD+2];
        /* Carrier Load                           String*/
        }SMDOpParams, *SMDOpParamsLP;
        /*
        **   ATM/ADSL Modem Defect Counters
        */
        typedef struct_smdLossOfDefects{
             DualEndMR loCellDeliniation;  /* Loss Of Cell
Deliniation*/
             DualEndMR IoSignal;      /* Loss Of Signal*/
             DualEndMR loPower;       /* Loss Of Power*/
             DualEndMR loFrame;       /* Loss Of Frame*/
        }SMDLossOfDefects, *SMDLossOfDefectsLP;
        /*
        **   ATM/ADSL Modem Channel Performance Counters
        */
        typedef struct _smdChannelPerf {
             long HECViolation;
             long FECsCorrected;
             long ErroredSeconds;
             long CodeViolations;
        }SMDChannelPerf, *SMDChannelPerfLP;

        /*
        **ATM/ADSL Modem Channel Status Data (This
combines all of the above!)
        */
        typedef struct _smdChannelStatus
             unsigned int        modemChannel;
             SMDOpParams    opParameters;
             SMDLossOfDefects    lossOfCounters;
             SMDChannelPerf performance;
             long           pollingOps;
             unsigned int        opMode;   /* 0 for
Interleaved and I for Fast
```

```
            unsigned int        opStatus;       /* Check
enum values above for status
            values. */
        }SM DChannel Status, *SMDChannelStatusLP;
        typedef struct_smdChannelStatusLst{
            struct -smdChannelStatusLst *previous;
            struct smdChannelStatusLst *next;
            SMDChannel Status chnlStatus;
        }SMDChannelStatusLst, *SMDChannelStatusLstLP;
        /*
        **  ATM Channel Performance Data.
        */
        typedef struct - smdVirtualConnStatus{
            DWORD     atmChannel;
            UINT      vpiValue;
            UINT      vciValue;
            long      cellsTrans;
            long      cellsRec;
            long      cellsDisc;
            long      aal5Msgs; /* Error detection Info
*/
            long      aal5Faults;
            long      elapsedTime; /* Time since last
polled for info*/
            BOOL      oamF4Enabled; /* Op. & Maint. Flow
Control (F4) enabled*/
            BOOL      oamF5 Enabled; /* Op. & Maint. Flow
Control (F4) enabled */
            BOOL      isActive;
        }SMDVirtualConnStatus, *SMDVirtualConnStatusLP;
        typedef struct_smdVirtualConnStatLst{
            struct_smdVirtualConnStatLst *previous;
```

```
                struct_smdVirtualConnStatLst *next;
                SMDVirtualConnStatus vcStatus;
           }SMDVirtualConnStatLst, *SMDVirtualConnStatLstLP;
           /*
           **Service Data list structure for service
information.
           */
           typedef struct _smdServiceData{
                DWORD atmChannel;   /* High word (VPI); Low
word (VCI)*/
                char userName[HAYES_MAX_SERVUSERNAME*2];
/*User defined tab                        name */
                char regName[HAYES_MAX_SERVREGNAME+10]; /*
Registered service                        */name
                BOOL svcConnType;   /* TRUE for SVC and FALSE
for PVC*/
                UINT vpiValue;
                UINT vciValue;
                UINT atmClass;
                UINT protocolUsed;  /* ATM, IPOA, FLANE,
etc.*/
                void *protocolSet;  /* Pointer to protocol
data structure */
                DWORD    peakValue;          /* High Word -
Up Stream; Low Word -
           Down Stream*/
                DWORD    minValue;
                DWORD    sustainValue;
                DWORD    burstTolValue;
           }SMDServiceData, *SMDServiceDataLP;
           typedef struct_srndServiceDataList {
                struct_smdServiceDataList *previous;
           struct_smdServiceDstaList *next;
           SMDServiceData servData;
       }SMDServiceDataList, *SMDServiceDataListLP;
      /*
      **   Protocol Data Structure for TCP/IP over ATM
or (IPOA)
      */
      typedef struct - smdIPOASettings{
          char ipSubnet[HAYES_MAX_IPADDRESS+2];
          char ipSubnetMask[HAYES_MAX_IPADDRESS+2];
          char arpServATMAddr[HAYES_MAX_ATMADDRESS+10];
          char arpServIPAddr[HAYES_MAX_IPADDRESS+2];
          char remotelPAddr[HAYES_MAX_IPADDRESS+2];
          char localIPAddr[HAYES_MAX_IPADDRESS+2];
          BOOL useDefGateway;
      }SMDIPOASettings, *SMDIPOASettingsLP;
      /*
      **   Protocol Data Structure for Forum LAN
Emulation
      */
      typedef struct - smdFLANESettings{
          BOOL useLECSAddress;     /* TRUE for Using
well know LECS Address*/
          char lecsATMAddress[HAYES_MAX_ATMADDRESS+10];
          char
lesATMAddress[HAYES_MAX_ATMADDRESS+10];
      }SMDFLANESetings, *SMDFLANESettingsLP;
      /*
      **   Global ATM Information
      */
      typedefstruct_smdGlobalATMSettings{
          /* Interface Information */
```

```
        char      atmAddress[HAYES_MAX_ATMADDRESS+10];
        BOOL      ilmiEnabled;
        UINT      signalingType;
        UINT      protSupport;
        BOOL      oamF4Enabled;
        BOOL      oamF5Enabled;
        BOOL      IlcSnapEnabled;
        DWORD     GuaranteedLn Rate;
        BOOL      PVPMode;
        char      userAtmAddress[HAYES_MAX_ATMADDRESS+10];
        /* Options Information */
        BOOL      postEnabled; /* Power On Self Test
Enabled (extended test) 0/
        BOOL      useGlobal Profile;
        BOOL      modemStatus Enabled.
        } SMDGlobalATMSettings, *SMDGlobalATMSettingsLP;

        #if defined(_CPLUSPLUS) 11 defined(C_PLUSPLUS)
        }
        #endif
        #endif
```

Communication Interface for ServiceMonitor

(ServiceMonitorComm.h)

**[0291]** Future releases of ServiceMonitor allows other applications to communicate with it for simple management functions. Such as browser notifying that new service connections need to be established from configuration files located on various Telco Web Sites. This header is used to simply place various registered messages for internal communication of classes to the main application dialog.

```
        //////////////////////////////////////////////////////
////////////
        //
        //ServiceMonitorComm.h : Main header file for all
applications to interface with          ServiceMonitor.
        //
        //Copyright (c) 1997 Hayes Microcomputer Products,
Inc.
        //

//////////////////////////////////////////////////////////
//////////
        #if!defined(SERVICEMONITORCOMM_H)
        #define SERVICEMONITORCOMM_H    1
        //Main Data types for all source code used to
interface with Service Monitor
        //This is the registered msg for ServiceMonitor to
be able to update the
        //system tray icon.
        #define SMWRM_NOTIFYTRAYICON_MSG
"SMWRM_SYSTEMNOTIFYICON"
        #define SMWRM_SERVICEMONITOR_EXIT_MSG
        "SMWRM_SERVICEMONITOR_EXIT"
        #define SMWRM_SERVICEMONITOR_SHOW_MSG
        "SMWRM_SERVICEMONITOR_SHOW"
        #endif
```

**[0292]** The ADSL PC NIC on-board controller also includes a Management Application resident thereon. The ADSL includes an interface to interact with the application running on the host PC. The Management Application controls various scenarios of operation of the ADSL NIC.

**[0293]** The term "Host" refers to the controlling application or driver running on the PC in which the ADSL NIC is installed. For the PC NIC, the term "near-end" is associated with the signal received locally by the NIC (the ATU-R), and the term "far-end" is associated with the signal received at the central office by the ATUC. The Management Application performs a number of tasks:

It accepts commands from the Host, and provides the necessary responses, as per the Modem Control Interface described below;

It controls the Modem Software as required to accomplish the Host's commands, and queries the Modem Software to obtain necessary information, as per the Modem software API; and

it monitors performance statistics and provides alarms for fault events.

**[0294]** Software can be downloaded from the host depending on the selected mode. A first mode, for e.g. normal operation, downloads the software. A second, e.g. for standalone, uses software that is resident in an on board non volatile RAM.

**[0295]** If software is downloaded, the on-board controller is kept in reset until the software download is completed. Direct memory accesses from the PC or Hydrogen chip into the on-board controller memory space is used to download the software.

**[0296]** The architecture of the ADSL NIC control firmware is shown in Figure 29. User data is not handled by the on-board controller. User data passes directly from the Hydrogen chip to the SACHEM over the UTOPIA interface as shown in the bottom portion.

**[0297]** Figure 29 also shows how the Management Application interacts with the Host 2902 through the Modem Control Interface 2904. The Management Application interacts with the ADSL Modem Software 2906 through the Modem SW API 2908.

**[0298]** The Modem Control Interface is the set of commands, responses and unsolicited responses that pass between the ADSL NIC Management Application and the controlling entity on the Host. The ADSL NIC has this interface between the on-board controller and the Hydrogen chip. Control information is typically exchanged between the Host and the Management Application, with the Hydrogen chip serving as an intermediary.

**[0299]** The interface between the on-board controller and the Hydrogen chip includes two 16-bit mailboxes 3000, 3002, shown in Figure 30, one for each direction. The mailboxes are implemented in hardware within ASIC 410 as described above. One mode provides compatibility with future hardware designs which may provide only an 8-bit path as shown in Figure 31. In this case, only the lower half of the data bus is used (bits 7-0). The upper eight bits are filled with zeros on write operations, and ignored on read operations.

**[0300]** Each mailbox has associated control bits e.g. 3010, indicating the fill state of the mailbox, e.g., full or empty. The mailbox drivers 3012 use these bits to control their accesses to the mailbox. The rules for accessing the mailbox are as follows and shown in Figure 32:

- In the outgoing direction, the mailbox driver does not write to the mailbox unless the mailbox is empty. The mailbox is empty when the MboxRSTA T bit in the IRQ Status register is set.
- In the incoming direction, the mailbox driver reads the mailbox when it is full. The mailbox is full when the Mbox WSTA T bit in the IRQ Status register is set.
- The MboxRSTAT and MboxWSTAT bits is used in either a polled or an interrupt-driven fashion by each driver independently. As part of the normal hardware initialization process, the ASIC IRQ Enable registers on each side must be configured properly to either enable or disable interrupts as desired.

**[0301]** If the above rules are followed, no data will be lost or overwritten in the mailbox.

**[0302]** The most likely failure that may occur is when a mailbox driver becomes unstable and ceases to service the mailbox. In this case, the other driver may find that it is unable to write to the mailbox. To handle this situation, a time-out of 1 ± 0.1 seconds is observed on write attempts to the mailbox shown in Step 3202. The expiration of this time-out represents a fatal error condition which calls for a reset. The Management Application responds to this time out by waiting until the Host-side driver responds or until the on-board controller is reset.

**[0303]** Since many commands and responses require more than 8 bits of information to be sent, a protocol is used to allow multiple-byte messages to be passed between the Management Application and the Host. A mailbox message has a consecutive string of bytes with the format shown in Figure 28.

**[0304]** This message includes address fields to identify the sending entity 2800 and receiving entity 2802. Typically, these entities will be the Management Application on the NIC and the Host Application running on the PC. However, other possible entities include debug ports on the Host debug processes on the NIC, or processes running on the Hydrogen chip. For messages that are responses to commands, the destination address is filled with the address of the entity that originated the command.

**[0305]** The driver on each side of the mailbox routes messages to the appropriate entity. In the interest of simplicity, addresses for all entities are fixed at compile time. Exemplary addresses are given in Table 1.

**[0306]** The SYNC and SYNC_ACK opcodes are used prior to the establishment of the protocol. Opcodes for these commands are not available to serve as entity addresses. Therefore these four addresses are reserved. Further details of the synchronization are described herein.

Table 1.

| Mailbox Entity Addresses | |
|---|---|
| **Entity** | **Address** |
| Host Control Application | 0x01 |
| Host Data Handler | 0x02 |
| Host Debug Port A | 0x03 |
| Host Debug Port B | 0x04 |
| Host Debug Port C | 0x05 |
| Host Debug Port D | 0x06 |
| On Board Controller Management Application | 0x10 |
| On Board Controller Management Selftest Agent | 0x11 |
| On Board Controller Management Debug Process 1 | 0x12 |
| On Board Controller Management Debug Process 2 | 0x13 |
| On Board Controller Management Debug Process 3 | 0x14 |
| On Board Controller Management Debug Process 4 | 0x15 |
| Hydrogen Debug Process 1 | 0x20 |
| Hydrogen Debug Process 2 | 0x21 |
| Hydrogen Debug Process 3 | 0x23 |
| Hydrogen Debug Process 4 | 0x24 |
| Reserved for SYNC | 0x55 |
| Reserved for SYNC_ACK | 0xAA |
| Reserved for SYNC | 0x33 |
| Reserved for SYNC_ACK | 0xCC |

**[0307]** The opcode field identifies the command or response being sent. It also indicates to the recipient how the data field should be interpreted.

**[0308]** The **Length of Data Field** value 2810 gives the length (in bytes) of the message data field. If there is no data field, this number is zero. In general, the correct length of the data field could be deduced from the opcode. However, providing a length field allows a mailbox driver (or an intermediate entity) to correctly handle a message even if the opcode is not recognized. This allows new opcodes to be added without requiring updates to all of the firmware on the NIC. Different versions of firmware on different CPUs may interwork more easily. The content of the data field depends on the opcode. For some opcodes, this field might not exist. For data fields with multiple bytes, the field format is given in the command or response definition.

**[0309]** The **Synchronization Procedure** is used to protect against spurious transmissions through the mailbox after power-up. The synchronization procedure is used by the Management Application and the Host-side mailbox driver on both the Host and the Hydrogen.

**[0310]** Essentially, the procedure requires transmission and acknowledgment of special SYNC opcodes three times in a row, to attain synchronization in each direction. Acknowledgment is through the SYNC_ACK opcode. Note that the SYNC and SYNC_ACK are messages but do not necessarily follow mailbox protocol described herein. These are formed by a one-byte message having only an opcode.

**[0311]** Synchronization is assumed to have been attained in the outgoing direction when three consecutively-sent SYNC opcodes have resulted in three consecutively-received SYNC_ACK opcodes. The SYNC process is then terminated, and the mailbox driver may begin using the mailbox protocol described above to transmit messages.

**[0312]** In the incoming direction, synchronization is assumed when three consecutive SYNC opcodes have been received. Any bytes received after this (other than SYNC) are interpreted as messages complying with the mailbox protocol. Any SYNC opcodes received after this point are simply acknowledged and then discarded, without causing a loss of synchronization.

**[0313]** Received SYNC opcodes are always acknowledged with SYNC_ACK opcodes.

**[0314]** The Host-side driver and the Management Application follow the same sequence. This procedure is typically necessary only after power-up or after reset.

**[0315]** During synchronization, the time-out period for writing to the mailbox and for polling for responses is 250 ± 50 msec. After synchronization is achieved, the time-out for mailbox write attempts changes to 1 ± 0.1 seconds.

**[0316]** There are three different kinds of NIC control messages. A first command can be issued to the Management Application. Responses can originate from the Management Application. Finally, general purpose messages may be sent from any entity to any other.

**[0317]** Table 2 lists commands that the Host may issue to the Management Application.

Table 2.

| Host Commands | | | |
|---|---|---|---|
| **Command** | **Opcode** | **Data Field Length** | **Data Field Contents** |
| MBOX_Sync | 0x55 | N/A | N/A |
| MBOX_Sync_Ack | 0xAA | N/A | N/A |
| ADSL_Selftest_Long | 0x01 | 0 | - |
| ADSL_Selftest_Short | 0x02 | 0 | - |
| ADSL_Open | 0x03 | 0 | - |
| ADSL_Close | 0x04 | 0 | - |
| ADSL_Report_Version | 0x05 | 0 | - |
| ADSL_Report_Vendor | 0x06 | 0 | - |
| ADSL_Report_Oper_Data | 0x07 | 0 | - |
| ADSL_Report_Carrier_Load | 0x08 | 0 | - |
| ADSL_Report_Channel_Data | 0x09 | 0 | - |
| ADSL_Report_Performance | 0x0A | 0 | - |
| ADSL_Report_Performance_Raw | 0x0B | 0 | - |
| ADSL_Report_Fault_Data | 0x0C | 0 | - |
| ADSL_Send_Dying_Gasp | 0x0D | 0 | - |
| ADSL_Report_Performance_Data | 0x0E | 0 | - |

**[0318]** **MBOX_Sync, MBOX_Sync_Ack** are responses that are sent by the Host-side mailbox driver after power-up or reset to establish synchronization with the Management Application mailbox driver. These responses do not have address fields or data fields.

**[0319]** **ADSL_Selftest_Long, ADSL_Selftest_Short** commands cause the on-board controller to initiate long or short self tests. The self test results are sent back to the Host using the ADSL_Selftest_Results response.

**[0320]** **ADSL_Open and ADSL_Close** control the ADSL connection. The ADSL _Open command causes the modem to attempt to connect with the ATU-C. The ADSL_Close command causes the ADSL modem to send a Dying Gasp message to the ATU-C, close the connection, and return to an idle state.

**[0321]** The **ADSL_Open** can result in a number of different operations. Figure 33 shows the process flow when the **ADSL_Open** succeeds. Figure 34 shows the **ADSL_Open** failing due to rejection. Figure 35 shows **ADSL_Open** failing due to timeout. Figure 36 shows **ADSL_Open** failing due to initialization failure. One related scenario is shown in Figure 37, which diagram the existing ADSL connection being lost.

**[0322]** Figure 38 diagrams the **ADSL_Close** request succeeding. Figure 39 shows the **ADSL_Close** being rejected.

**[0323]** The **ADSL_Report...** commands are used to request information from the Management Application.

**[0324]** The **ADSL_Send_Dying_Gasp** command instructs the modem to send a Dying Gasp message to the ATU-C. The modem remains connected after sending the message.

**[0325]** Figure 40 illustrates the operation of the host requesting version or vendor IDs. Figure 41 shows the host requesting the near or far end operational data, and Figure 42 shows the host requesting the channel operational data. The host can also request performance counters, as shown in Figure 43.

**[0326]** Table 3 lists the Management Application responses. Some responses are sent only as answers to Host commands. Other responses are sent spontaneously as certain events occur. When the unsolicited responses occur, they are addressed to the host "owner" application--that is, the application which issued the most recent successful ADSL_Open command. On power-up, the owner address defaults to 0x01.

Table 3.

| **Management Application Responses** | | | |
|---|---|---|---|
| **Response** | **Opcode** | Data Field **Length** | **Data Field Contents** |
| MBOX_Sync * | 0x33 | N/A | N/A |
| MBOX_Sync_Ack | 0xCC | N/A | N/A |
| ADSL_Open_Rejected | 0x21 | 3 | reason and duration |
| ADSL_Open_Failed | 0x22 | 1 | error code |
| ADSL_Open_Failed_on_Timeout | 0x23 | 0 | - |
| ADSL_Connection_Opened | 0x24 | 0 | - |
| ADSL_Connection_Lost* | 0x41 | 0 | - |
| ADSL_Connection_Closed | 0x25 | 0 | - |
| ADSL_Close_Rejected | 0x26 | 1 | reason |
| ADSL_Selftest Resultes | 0x27 | 1 | result code |
| ADSL_Version | 0x28 | 2 | near-and far-end versions |
| ADSL_Vendor | 0x29 | 2 | near-and far-end versions |
| ADSL_Oper_Data | 0x2A | 8 | near-end operational data |
| ADSL_Carrier_Load | 0x2B | 128 | carrier laed data |
| ADSL_Oper_Data_Unavail | 0x2C | 0 | - |
| ADSL_Channel_Data | 0x2D | 8 | channel bit rates |
| ADSL_Performance | 0x2E | 20 | per-sec. performance data |
| ADSL_Performance_Raw | 0x3F | 32 | performance data (raw) |
| ADSL_Perf_Unavail | 0x30 | 0 | - |
| ADSL_Fault_Data | 0x31 | 42 | fault counters and defects |
| ADSL_Fault_Data_Unavail | 0x32 | 0 | - |
| ADSL_Dying_Gasp_Sent | 0x34 | 0 | - |
| ADSL_Dying_Gasp_Rej | 0x35 | 0 | - |
| ADSL_Performance_Delta | 0x36 | 32 | delta performance counters |
| FAULT_Declared* | 0x42 | 1 | type of fault |
| FAULT_Ended* | 0x43 | 1 | type of fault |
| FAULT_Deactivate* | 0x44 | 2 | shutdown time (sec) |

* indicates an unsolicited response

**[0327]** **MBOX_Sync and MBOX_Sync_Ack** responses are sent by the Management Application mailbox driver after power-up or reset to establish synchronization with the Host-side mailbox driver. These responses do not have address fields or data fields.

**[0328]** The **ADSL_Open_Rejected** response is returned if the modem is already connected or attempting to connect, or if an operator-initiated line test is in progress. The data field has 3 bytes. Byte 0 gives the reason for the rejection--0x00 indicates that the line is not down; 0x01 indicates that a test is in progress. If the reason is that a test is in progress, bytes 1 and 2 give the time remaining in the test (in seconds), with the LSB in byte 1 and the MSB in byte 2. Otherwise, the data field will not have meaningful data.

**[0329]** The **ADSL_Open_Failed** response indicates a failure has occurred during the initialization process. An error code is returned in the data field, as shown in Table 4.

Table 4.

| Error for ADSL_Open_Failed | | |
|---|---|---|
| **Error Code** | **Mnemonic** | **Explanation** |
| 0x05 | REQ_BITRATE_TOO_HIGH | Bit rate requested by ATU-C cannot be supported |
| 0x0A | NO_LOCK-POSSIBLE | Unable to lock with ATU-C |
| 0x0F | PROTOCOL_ERROR | A failure occurred during the initialization process |
| 0x14 | MESSAGE_ERROR | A message received from the ATU-C was invalid (incorrect CRC or wrong format) |

**[0330]** If the modem is unable to connect with the ATU-C, and yet does not report a failure, the Management Application stops the attempt after a time-out period. This scenario could arise, for example, as a result of the ATU-C not functioning or the telephone wire being cut. The time-out period is 1 minute after the ADSL_Open request The **ADSL_Connection_Opened** indicates that the ADSL_Open request has succeeded and that a connection has been established with the ATU-C. The **ADSL_Connection_Lost** is sent if the line capacity deteriorates to the point where the requested bit rates can no longer be supported. This is an unsolicited response. The **ADSL_Connection_Closed** is sent to indicate that an ADSL_Close request has been successful.

**[0331]** An **ADSL_Close** request will be rejected if the modem is currently down, or if the issuer of the ADSL_Close is not the "owner" application which issued the ADSL_Open;. The **ADSL_Close_Rejected** response indicates this rejection with a one-byte data field which gives the reason for the rejection: 0x00 indicates that the modem is not down; 0x01 indicates that the issuer is not the owner.

**[0332]** The **ADSL_Selftest_Results** response gives selftest results. The data field has one byte, which contains the self test result code, as given in Table 5.

Table 5.

| Selftest Result Codes | | |
|---|---|---|
| **Result Code** | **Mnemonic** | **Meaning** |
| 0x0000 | Selftest_Short_OK | The short selftest detected no problems |
| 0x0001 | Selftest_Short_Warning | The short selftest detected a non-fatal problem |
| 0x0002 | Selftest_Short_Error | The short selftest detected a failure |
| 0x0003 | Selftest_Long_OK | The long selftest detected no problems |
| 0x0004-0x???? | Selftest_Long_... | Long selftest error codes |

**[0333]** The **ADSL_Version** response returns the versions of the near-end and far-end ADSL modems. The data field contains two bytes. The near-end version is given first in time; the far-end version is given second. The near-end version is always available. The availability of the far-end version is given in Table 6.

Table 6.

| Availability of Far-End Version and Far-End Vendor | |
|---|---|
| **Modem State** | Availability of Far-End Version and **Vendor** |
| Down, after power-up | available as 0xFF |
| Initializing a connection | available as either 0xFF or as actual value |
| Connected | actual value available |
| Down, after connection is closed or fails | value from previous connection is available |

**[0334]** The **ADSL_Vendor** response reports the vendors of the near-end and far-end ADSL modems. The data field is two bytes long with the near-end vendor being reported first; the far-end vendor is reported second. The vendor number for Alcatel is 0x0022. The near-end vendor is always available. The availability of the far-end vendor is given in Table 6.

**[0335]** The **ADSL_Oper_Data** response returns the operational data for the near and far ends of the line. Eight bytes are reported, as shown in Table 7. The availability of this data is given in Table 8. Note: For the PC NIC, the relCapacity0ccupationDnstr value will be limited to a maximum of 100.

Table 7.

| **Data Field for ADSL_Oper_Data_Near** | | |
|---|---|---|
| **Byte** | **Mnemonic** | **Meaning** |
| 0 (first in time) | relCapacityOccupationDnstr | downstream bit rate as a percentage of the maximum attainable (Bmax) |
| 1 | noiseMarginDnstr | amount of increased noise (dB loss in SNR) that can be tolerated while maintaining a downstream BER of 10-7 |
| 2 | outputPowerUpstr | ATU-R transmit power level (dBm) |
| 3 | attenuationDnstr | difference in dB between the power received by the ATU-R and a reference ATU-C transmit power level |
| 4 | relCapacityOccupationUpstr | upstream bit rate as a percentage of the maximum attainable (Bmax) |
| 5 | noiseMarginUpstr | amount of increased noise (dB loss in SNR) that can be tolerated while maintaining an upstream BER of 10-7 |
| 6 | outputPowerDnstr | ATU-C transmit power level (dBm) |
| 7 | attenuationUpstr | difference in dB between the power received by ATU-C and a reference ATU-R transmit power level |

Table 8.

| **Availability of Operational Data and Raw Performance Data** | |
|---|---|
| **Modem State** | **Availability of Operational Data** |
| Down, after power-up | available as 0xFF |
| Initializing a connection | not available |
| Connected | valid data available |
| Down, after connection is closed or fails | data from previous connection is available |

**[0336]** The **ADSL_Carrier_Load** response returns the bit-per-symbol loading for each carrier bin across the ADSL frequency band. The values for the 256 bins are packed two per byte with a total data length of 128 bytes. The values are given in order of increasing frequency. For each byte, the lower- frequency value is in the upper nibble as shown in Table 10.

Table 10.

| **Data field for ADSL_Carrier_Load** | |
|---|---|
| **Nibble** | **Data** |
| byte 0, upper nibble | load for carrier 0 |
| byte 0, lower nibble | load for carrier 1 |
| ... | ... |
| byte 127, upper nibble | load for carrier 254 |
| byte 127, lower nibble | load for carrier 255 |

**[0337]** **ADSL_Oper_Data_Unavail** means that operational data is not available. This happens while the modem is initializing a connection.

**[0338]** The **ADSL_Channel_Data** response returns the 16-bit quantities indicating bit rates for the fast and interleaved channels for the near and far ends. Table 11 shows the data field. The availability of this data is given in Table 8.

Table 11.

| Data Field for ADSL_Channel_Data Response | | | |
|---|---|---|---|
| **Byte** | **Mnemonic** | **Bits** | **Meaning** |
| 0 (first in time) | ChanDataIntNear | 7-0 | near-end interleaved channel bit rate (kbits/sec) |
| 1 | | 15-8 | |
| 2 | ChanDataFastNear | 7-0 | near-end fast channel bit rate (kbits/sec) |
| 3 | | 15-8 | |
| 4 | ChanDataIntFar | 7-0 | far-end interleaved channel bit rate (kbits/sec) |
| 5 | | 15-8 | |
| 6 | ChanDataFastFar | 7-0 | far-end fast channel bit rate (kbits/sec) |
| 7 | | 15-8 | |

**[0339]** The **ADSL_Performance** reports 8-bits representing ADSL modem performance counters maintained by the Management Application. These counters are polled from the Modem SW once per second, and hence can be interpreted as per-second quantities. These counters are frozen while defects are being experienced on their respective end. The ADSL_Performance response also reports the two 32-bit Quality of Service parameters maintained by the Management Application, Near-End Errored Seconds and Far-End Errored Seconds.

**[0340]** The data field format for the ADSL_Performance response is given in Table 12. Note that byte 0 is first in time.

**[0341]** The ADSL_Performance counters are always available.

Table 12.

| Data Field for ADSL_Performance | | |
|---|---|---|
| **Byte** | **Mnemonic** | **Description** |
| 0 | near-end fec-ni | Number of near-end received superframes with one or more Reed-Solomon corrections in a dat frame (non-interleaved) |
| 1 | near-end fec-l | Number of near-end received superframes with one or more Reed-Solomon corrections in a data frame (interleaved) |
| 2 | near-end crc-ni | Number of near-end received superframes with an incorrect CRC in the non-interleaved path |
| 3 | near-end crc-l | Number of near-end received superframes with an incorrect CRC in the interleaved path |
| 4 | near-end hec-ni | Number of near-end received superframes with at least one cell with an errored HEC (non-interleaved) |
| 5 | near-end hec-l | Number of near-end received superframes with at least one cell with an errored HEC (interleaved) |
| 6 | far-end fec-ni | Number of far-end received superframes with one or more Reed-Solomon corrections in a data frame (non-interleaved) |
| 7 | far-end fec-l | Number of far-end received superframes with one or more Reed-Solomon corrections in a data frame (interleaved) |
| 8 | far-end crc-ni | Number of far-end received superframes with an incorrect CRC in the non-interleaved path |
| 9 | far-end crc-l | Number of far-end received superframes with an incorrect CRC in the interleaved path |

Table 12. (continued)

| Data Field for ADSL_Performance | | |
|---|---|---|
| Byte | Mnemonic | Description |
| 10 | far-end hec-ni | Number of far-end received superframes with at least one cell with an errored HEC (non-interleaved) |
| 11 | far-end hec-I | Number of far-end received superframes with at least one cell with an errored HEC (interleaved) |
| | near-end ES: | Near-end Errored Seconds: number of seconds which contain near-end |
| 12 | bits 7-0 | CRC anomalies (ni or I, or LOS or LOF defects |
| 13 | bits 15-8 | |
| 14 | bits 23-16 | |
| 15 | bits 31-24 | |
| | far-end ES: | Far-end Errored Seconds: number of seconds which contain far-end CRC anomalies (ni or I), or LOS or LOF defects |
| 16 | bits 7-0 | |
| 17 | bits 15-8 | |
| 18 | bits 23-16 | |
| 19 | bits 31-24 | |

**[0342]** The **ADSL_Performance_Raw** response reports the raw 16-bit ADSL modem performance counter values as polled at the time of the Host request. Two 32-bit Quality of Service parameters maintained by the Management Application, Near-End Errored Seconds and Far-End Errored Seconds are also reported.

**[0343]** The data field format is given in Table 13. Byte 0 is first in time. The availability of the raw performance counters is given in Table 8.

Table 13.

| Data Field for ADSL_Performance_Raw and ADSL_Performance_Delta | | | |
|---|---|---|---|
| Byte | Mnemonic | Bits | Description |
| 0 | near-end fec-ni | 7-0 | Number of near-end received superframes with one or more Reed-Solomon corrections in a data frame (non-interleaved) |
| 1 | | 15-8 | |
| 2 | near-end fec-I | 7-0 | Number of near-end received superframes with one or more Reed-Solomon corrections in a data frame (interleaved) |
| 3 | | 15-8 | |
| 4 | near-end crc-ni | 7-0 | Number of near-end received superframes with an incorrect CRC in the non-interleaved path |
| 5 | | 15-8 | |
| 6 | near-end crc-I | 7-0 | Number of near-end received superframes with an incorrect CRC in the interleaved path |
| 7 | | 15-8 | |
| 8 | near-end hec-ni | 7-0 | Number of near-end received superframes with at least one cell with an errored HEC (non-interleaved) |
| 9 | | 15-8 | |
| 10 | near-end hec-I | 7-0 | Number of near-end received superframes with at least one cell with an errored HEC (interleaved) |

Table 13. (continued)

| Data Field for ADSL_Performance_Raw and ADSL_Performance_Delta | | | |
|---|---|---|---|
| Byte | Mnemonic | Bits | Description |
| 11 | | 15-8 | |
| 12 | far-end fec-ni | 7-0 | Number of far-end received superframes with one or more Reed-Solomon corrections in a data frame (non-interleaved) |
| 13 | | 15-8 | |
| 14 .. | far-end fec-I | 7-0 | Number of far-end received superframes with one or more Reed-Solomon corrections in a data frame (interleaved) |
| 15 | | 15-8 | |
| 16 | far-end crc-ni | 7-0 | Number of far-end received superframes with an incorrect CRC in the non-interleaved path |
| 17 | | 15-8 | |
| 18 | far-end crc-I | 7-0 | Number of far-end received superframes with an incorrect CRC in the interleaved path |
| 19 | | 15-8 | |
| 20 | far-end hec-I | 7-0 | Number of far-end received superframes with at least one cell with an errored HEC (non-interleaved) |
| 21 | | 15-8 | |
| 22 | far-end hec-I | 7-0 | Number of far-end received superframes with at least one cell with an errored HEC (interleaved) |
| 23 | | 15-8 | |
| 24 | near-end ES | 7-0 | Near-end Errord Seconds: number of seconds which contain near-end CRC anomalies (ni or I), or LOS or LOF defects |
| 25 | | 15-8 | |
| 26 | | 23-16 | |
| 27 | | 31-24 | |
| 28 | far-end ES | 7-0 | Far-end Errored Seconds: number of seconds which contain far-end CRC anomalies (ni or I), or LOS or LOF defects |
| 29 | | 15-8 | |
| 30 | | 23-16 | |
| 31 | | 31-24 | |

**[0344]** The **ADSL_Perf_Unavail** response indicates that performance data is not available. Raw performance data is not available, for example, while a connection is being initialized.

**[0345]** The **ADSL_Fault_Data** response reports the various fault counters maintained by the Management Application, as well as the current state of the defects bitmap. The counters are all 32 bits in length. Table 14 gives the data field format for this response. Fault data availability is given in Table 15.

Table 14.

| Data Field for ADSL_Fault_Data_Response | | |
|---|---|---|
| Byte | Fault Counter | Bits |
| 0 | Near-End Loss of Signal | 7-0 |
| 1 | | 15-8 |
| 2 | | 23-16 |

Table 14. (continued)

| Data Field for ADSL_Fault_Data_Response | | |
|---|---|---|
| **Byte** | **Fault Counter** | **Bits** |
| 3 | | 31-24 |
| 4 | Near-End Loss of Signal | 7-0 |
| 5 | | 15-8 |
| 6 | | 23-16 |
| 7 | | 31-24 |
| 8 | Near-End Loss of Cell Delineation, ni | 7-0 |
| 9 | | 15-8 |
| 10 | | 23-16 |
| 11 | | 31-24 |
| 12 | Near-End Loss of Cell Delineation,i | 7-0 |
| 13 | | 15-8 |
| 14 | | 23-16 |
| 15 | | 31-24 |
| 16 | Far-End Loss of Cell Delineation, ni | 7-0 |
| 17 | | 15-8 |
| 18 | | 23-16 |
| 19 | | 31-24 |
| 20 | Far-End Loss of Cell Delineation, I | 7-0 |
| 21 | | 15-8 |
| 22 | | 23-16 |
| 23 | | 31-24 |
| 24 | Near-End Loss of Frame | 7-0 |
| 25 | ' | 15-8 |
| 26 | | 23-16 |
| 27 | | 31-24 |
| 28 | Far-End Loss of Frame | 7-0 |
| 29 | | 15-8 |
| 30 | | 23-16 |
| 31 | | 31-24 |
| 32 | Near-End Loss of Frame | 7-0 |
| 33 | | 15-8 |
| 34 | | 23-16 |
| 35 | | 31-24 |
| 36 | Far-End Loss of Margin | 7-0 |
| 37 | | 15-8 |
| 38 | | 23-16 |
| 39 | | 31-24 |

Table 14. (continued)

| Data Field for ADSL_Fault_Data_Response | | |
|---|---|---|
| **Byte** | **Fault Counter** | **Bits** |
| 40 | Near-End Defects recent status | |
| 41 | Far-End Defects recent status | |

Table 15.

| Availability of Fault Data | |
|---|---|
| **Modem State** | **Fault Data Availability** |
| Down, after power-up | available as 0x0000 |
| Initializing a connection | not available |
| Connected | valid data available |
| Down, after connection is closed of fails | data from previous connection available |

**[0346]** The **ADSL_Fault_Data_Unavail** response indicates that the requested fault data is not available. Fault data is not available while the modem is initializing a connection. The **ADSL_Dying_Gasp_Sent** indicates that a Dying Gasp has been sent as a result of an **ADSL_Send_Dying_Gasp** command. This response is not generated as a result of an **ADSL_Close** command. The **ADSL_Dying_Gasp_Rej** indicates that the Dying Gasp request has been rejected. This occurs if the modem is not connected.

**[0347]** The **ADSL_Performance_Delta** response is similar to the ADSL_Performance response. This response reports changes or "deltas" from the previous host read, rather than per-second quantities. With the exception of the Errored Second counters, these counters represent totals accumulated since the last read from the host. As such, there is a possibility that these counters may overflow or "wrap" if the host does not read them frequently enough. The counters are 16 bits each--and the maximum rate of increase of any count is 58 per second. Therefore, in the worst case, the counters will wrap after about 18 minutes. It is preferable, therefore, to read them more often than this. [CLAIM]

**[0348]** The Errored Second counters do not reset upon being read. These counters give totals of errored seconds accumulated since one second after the beginning of Showtime.

**[0349]** The data field format (which is the same as the **ADSL_Performance_Raw** format) is given in Table 13.

**[0350]** The **FAULT_Declared** response is used to indicate the occurrence of a fault. It is spontaneously sent to the Host whenever a fault condition is declared. This one-byte data field has a code indicating the type of fault that has occurred. Table 16 shows the different kinds of faults.

**[0351]** The **System_Error** fault indicates that a serious error has occurred which calls for a hard reset and software reload. One example is the time out of the mailbox, as described above.

Table 16.

| Fault Codes for FAULT_Declared and FAULT_Ended | | |
|---|---|---|
| **Fault Code** | **Fault Meaning** | **Meaning** |
| 0x01 | Loss_of_Signal_Near | Near-End Loss of Signal |
| 0x02 | Loss_of_Signal_Far | Far-End Loss of Signal |
| 0x03 | Loss_of_CD_Near_ni | Near-End Loss of Cell Delineation, non-Interleaved |
| 0x04 | Loss_of_CD_Near_i | Near-End Loss of Cell Delineation, Interleaved |
| 0x05 | Loss_of_CD_Far_ni | Far-End Loss of Cell Delineation, non-Interleaved |
| 0x06 | Loss_of_CD_Far_i | Far-End Loss of Cell Delineation, Interleaved |
| 0x07 | Loss_of_Frame_Near | Near-End Loss of Frame |
| 0x08 | Loss_of_Frame_Far | Far-End Loss of Frame |
| 0x09 | System_Error | Fatal System Error which calls for a reset |

Table 16. (continued)

| Fault Codes for FAULT_Declared and FAULT_Ended | | |
|---|---|---|
| **Fault Code** | **Fault Meaning** | **Meaning** |
| 0x0A | Loss_of_Margin_Near | Near-End Loss of Margin |
| 0x0B | Loss_of_Margin_Far | Far-End Loss of Margin |

**[0352]** **FAULT_Ended** is a response that indicates the termination of a fault condition. It is spontaneously sent to the Host whenever a fault condition is terminated. The one-byte data field contains a code indicating the type of fault that has ended (see Table 16). (FLOWCHART]

**[0353]** The **ADSL_Deactivate** response indicates that the ADSL modem has been shut down. This allows, for example, the operator to perform line tests.

**[0354]** When this request is received by the on board controller Management Application, the modem is automatically shut down, and the host receives an ADSL_Deactivate response. The on-board controller Management Application then enforces a lock-out period for the duration of the test. During this time, any ADSL_Open requests received from the host are rejected using, *e.g.*, the **ADSL_Open_Rejected.**

**[0355]** The two-byte data field gives the duration of the test in seconds (up to 300). The first data byte has bits 7-0 of the test duration with the second data byte having bits 15-8.

**[0356]** In addition to the above, general purpose messages may be sent from any entity to any other. These are listed in Table 17.

Table 17.

| General Purpose Messages | | | |
|---|---|---|---|
| **Command** | **Opcode** | **Data Field Length** | **Data Field Contents** |
| GENERIC_Character | 0x81 | 1 | ASCII character |
| GENERIC_Integer | 0x82 | 1 | 8 bit number |
| GENERIC_Byte | 0x83 | 1 | unspecified |

**[0357]** The **GENERIC_Character** message can be used to send ASCII characters from one entity to another. The data field has the ASCII character code. The **GENERIC_Integer** may similarly be used to send integers from one entity to another. The data field has an 8-bit unsigned integer. The **GENERIC_Byte** message may be used to carry any 8 bit data value. The meaning of the value is left up to the sending and receiving entities.

**[0358]** The Management Application and the Modem Software can interact in ways which do not involve the Host. These are given in the Interface Specification "SWB-Modem SW Architecture" (Alcatel Document 3EC 15576 AAAA PBZZA). Other **Combined Scenarios** describe the interaction between the Host, the Management Application, and the Modem Software.

**[0359]** The Management Application monitors the modem performance counters and the defects bitmap to maintain performance data and to detect fault conditions. Definitions of the modem defects and performance primitives are found in [TRANSPORT].

**[0360]** Performance data is provided to the host in three forms.

**[0361]** The **ADSL_Performance** response provides performance data in the form of per-second quantities. These values can be taken as error-per-second data. As such, these counters will never have values greater than 58 (the number of superframes per second). These values are correlated with defects by the on-board controller Management Application as recommended in [TRS]. The polling period for these counters is one second.

**[0362]** The **ADSL_Performance_Delta** response provides performance data in the form of reset-on-read counters. These counters are correlated with line defects. In order to prevent overflow, these counters should be read at least once every 18 minutes. These counters are updated once per second.

**[0363]** The **ADSL_Performance_Raw** response provides the values of the raw 16-bit free-running counters given by the modem software. These counters are not correlated with line defects. In addition, the values reported are accurate only at the time of polling; therefore, latency issues may make it difficult for the host to interpret this data correctly. [CLAIM 3 DIFFERENT WAYS]

**[0364]** In addition, all three of the above mentioned responses provide Errored Second counters that represent the accumulated total of errored seconds since the beginning of Showtime. They are 32 bits in length and do not reset when read.

**[0365]** When near-end defects are being experienced, the near-end and far-end performance counters are frozen. Near-End Errored Seconds, however, are not frozen. When far-end defects are being experienced, far-end counters (except Far-End Errored Seconds) will be frozen. This correlation applies to the **ADSL_Performance** and **ADSL_Performance_Delta** responses only.

**[0366]** The **Near-End Errored Seconds** parameter is a 32-bit count of one-second intervals which contain one or more near-end cyclic redundancy code (CRC) (interleaved or non-interleaved) anomalies, or one or more near-end LOS or near-end LOF defects. The count begins 1 second after the modem enters Showtime, enabling any initial errors from reset or SYNC problems to be ignored.

**[0367]** The Far-End Errored Seconds parameter is a 32-bit count of one-second intervals which contain one or more far-end CRC (interleaved or non-interleaved) anomalies, or one or more far-end LOS or far-end LOF defects. The count begins 1 second after the modem enters Showtime.

**[0368]** The Management Application polls the defects bitmap every 0.5 seconds in order to detect the fault conditions listed below. Each fault type is associated with a 32-bit counter, which contains the number of faults that have occurred since 1 second after the beginning of Showtime.

**[0369]** Far-end (ATU-C) defects are ignored while the ATU-R is experiencing near-end defects.

**Near-and Far-End Loss of Signal (LOS)**

**[0370]** A Near-End Loss of Signal fault is declared when either:

- the near-end LOS defect has been observed to be continuously active for 2.5 ± 0.5 seconds; or
- the near-end LOS defect is present and the criteria for a Near-End Loss of Frame fault have been met.

**[0371]** Analogously, a Far-End Loss of Signal fault is declared when either:

- the far-end LOS defect has been observed to be continuously active for 2.5 ± 0.5 seconds; or
- the far-end LOS defect is present and the criteria for a Far-End Loss of Frame fault has been met.

**[0372]** The Host is notified of these faults through the **FAULT_Declared(Loss_of_Signal_Near)** and **FAULT_Declared(Loss_of_Signal_Far)** responses, respectively.

**[0373]** A Near-End Loss of Signal fault condition is terminated when the near-end LOS defect has been absent for 10 ± 0.5 seconds. The Host shall be notified through the **FAULT_Ended(Loss_of_Signal_Near)** response.

**[0374]** A Far-End Loss of Signal fault condition is terminated when the far-end LOS defect has been absent for 10 ± 0.5 seconds. The Host is notified through the **FAULT_Ended(Loss_of_Signal_Far)** response.

**[0375]** Starting 1 second after the beginning of Showtime, the number of Near-End and Far-End Loss of Signal faults are maintained in 32-bit counters, which can be, for example, values from software counters. The Host may obtain these counters using the **ADSL_Report_Fault_Data** command. The values are reported in the **ADSL_Fault_Data** response.

**Near-and Far-End Loss of Cell Delineation (LCD)**

**[0376]** A Near-End Loss of Cell Delineation fault is declared when either of the near-end LCD defects (interleaved or non-interleaved) is continuously active for 2.5 ± 0.5 seconds, except if one of the following conditions exist:

- the near-end LOS defect is present;
- the near-end LOF defect is present;
- a Near-End Loss of Signal fault is declared; or
- a Near-End Loss of frame fault is declared.

**[0377]** If any of these conditions holds, a fault is not declared.

**[0378]** A Far-End Loss of Cell Delineation fault is declared when either of the far-end LCD defects (interleaved or non-interleaved) has been observed to be continuously active for 2.5 ± 0.5 seconds, except if one of the following conditions exist:

- the far-end LOS defect is present;
- the far-end LOF defect is present;

- a Far-End Loss of Signal fault is declared; or
- a Far-End Loss of Frame fault is declared.

**[0379]** If any of these conditions holds, a fault is not declared.
**[0380]** The four types of LCD errors and the corresponding Host notifications are shown in Table 18.

Table 18.

| Loss of Cell Delineation Faults | | |
|---|---|---|
| **Defect** | **Explanation** | **Response sent to Host** |
| near-end LCD-ni | Loss of Cell Delineation, Near-End, Non-Interleaved | FAULT_Declared (Loss_of_CD_Near_ni) |
| near-end LCD-I | Loss of Cell Delineation, Near-End, Interleaved | FAULT_Declared (Loss_of_CD_Near_i) |
| far-end LCD-ni | Loss of Cell Delineation, Far-end, Non-Interleaved | FAULT_Declared (Loss_of_CD_Far_ni) |
| far-end LCD-I | Loss of Cell Delineation, Far-end, Interleaved | FAULT_Declared (Loss_of_CD_Far_i) |

**[0381]** A Near-End Loss of Cell Delineation fault condition is terminated when any of the following conditions becomes true:

- a Near-End Loss of Frame failure is declared;
- a Near-End Loss of Signal failure is declared; or
- the near-end LCD defect is absent for 10 ± 0.5 seconds.

**[0382]** The Host shall be notified through the **FAULT_Ended(Loss_of_CD_Near_ni)** or the **FAULT_Ended(Loss_of_CD_Near_i)** response, as appropriate.
**[0383]** A Far-End Loss of Cell Delineation fault condition is terminated when any of the following conditions becomes true:

- a Far-End Loss of Frame failure is declared;
- a Far-End Loss of Signal failure is declared; or
- the far-end LCD defect has been absent for 10 ± 0.5 seconds.
  The Host is notified through the **FAULT_Ended(Loss_of_ Cd_Far_ni)** or the **FAULT_Ended (Loss_of_CD_Far_i)** response, as appropriate.

**[0384]** Starting 1 second after the beginning of Showtime, the number of Near-End Loss of Cell Delineation faults and the number of Far-End Loss of Cell Delineation faults are maintained in 32-bit counters. The Host may obtain these counters using the **ADSL_Report_Fault_Data** command, reported in the **ADSL_Fault_Data response**.
**[0385]** A Near-End Loss of Frame fault is declared when the near-end LOF defect has been observed to be continuously active for 2.5 ± 0.5 seconds, except when either of the following conditions are true:

- the near-end LOS defect is active; or
- a Near-End Loss of Signal fault has been declared.

**[0386]** If either of these conditions is true, no fault is declared.
**[0387]** If a fault is declared, the Host is notified through the **FAULT_Declared(Loss_of_Frame_Near)** response.
**[0388]** A Far-End Loss of Frame fault is declared when the far-end LOF defect has been observed to be continuously active for 2.5 ± 0.5 seconds, except when either of the following conditions are true:

- the far-end LOS defect is active; or
- a Far-End Loss of Signal fault has been declared.

**[0389]** If either of these conditions is true, no fault is declared.
**[0390]** If a fault is declared, the Host is notified through the **FAULT_Declared(Loss_of_Frame)** response.
**[0391]** A Near-End Loss of Frame fault is terminated if either of the following conditions becomes true:

- a Near-End Loss of Signal fault is declared; or

- the near-end LOF defect is absent for 10 ± 0.5 seconds.

**[0392]** The Host is notified of the termination of the fault through the **FAULT_Ended(Loss_of_Frame_Near)** response.

**[0393]** A Far-End Loss of Frame fault is terminated if either of the following conditions becomes true:

- a Far-End Loss of Signal fault is declared; or
- the far-end LOF defect has been absent for 10 ± 0.5 seconds.

**[0394]** The Host is notified of the termination of the fault through the **FAULT_Ended(Loss_of_Frame_Far)** response.

**[0395]** Starting 1 second after the beginning of Showtime, the number of Near-End Loss of Frame faults and Far-End Loss of Frame faults are maintained in 32-bit counters. The Host may request these counters using the **ADSL_Report_Fault_Data** command. The values are reported in the **ADSL_Fault_Data** response.

**[0396]** A Near-End Loss of Margin fault is declared when the near-end LOM defect is observed to be continuously active for 2.5 ± 0.5 seconds. The host shall be notified through the
**FAULT_Declared(Loss_of_Margin_Near)** response.

**[0397]** A Far-End Loss of Margin fault is declared when the far-end LOM defect has been observed to be continuously active for 2.5 ± 0.5 seconds. The host is notified through the
**FAULT_Declared(Loss_ of_Margin_Far)** response.

**[0398]** The Near-End Loss of Margin fault is conversely terminated'when the near-end LOM defect has been observed to be continuously absent for 10 ± 0.5 seconds. The host is notified through the **FAULT_Ended (Loss_of_Margin_Near)** response.

**[0399]** A Far-End Loss of Margin fault is terminated when the far-end LOM defect has been observed to be continuously absent for 10 ± 0.5 seconds. The host shall be notified through the **FAULT_Ended(Loss_of_Margin_Far)** response.

**[0400]** Starting 1 second after the beginning of Showtime, the number of Near-end and Far-End Loss of Margin faults are maintained in 32-bit counters. The host may request these counters using the ADSL_Report_Fault_Data command.

**[0401]** The basic installation process is shown in Figure 47.

**[0402]** When ServiceMonitor is first started the user needs to configure services for the first time. The user is prompted through a message box that no services have been installed and asked if he/she wants to install a new service now. If the user elects to install services later, then that could be done by going to the "ServiceMonitor Properties" dialog off the main dialog and selecting "Install New" (See Figure 20) or by selecting "Install New Service" off the System Tray Icon (See Figure 19).

**[0403]** The installation wizard dialogs follow the basic philosophy of guiding the user through the type of installation. The flow-chart in Figure 48 demonstrates the pattern of questions for the user to answer for installation of a new service.

**[0404]** The user can choose to remove an installed service via the "ServiceMonitor Properties" dialog as shown in Figure 19. The service tab to be removed is selected, and then select "Uninstall". This prompts the user with a dialog, warning them of their actions, and asking for confirmation of the removal action. If the user selects "OK", then the service is removed and the tabs are updated to reflect this removal.

**[0405]** The normal operation of ServiceMonitor after boot-up and logon is to start up in the System Tray. Alternately, ServiceMonitor can start as a minimized application. Figure 19 shows some of the standard interaction with ServiceMonitor as it is in the System Tray.

**[0406]** ServiceMonitor was designed to be minimally intrusive and to provide as much feedback to the user as possible, in an easy manner. The Tray Icon has three artificially-simulated LEDs, of which the left represents transmission of data while the right represents data received. These two LEDs alternate between dark red and bright green colors for data movement. Bright red would indicate some sort of error in the data flow. The center LED is used to indicate line sync with the ADSL Modem. For this LED, red would indicate loss of sync and bright green is the normal condition.

**[0407]** Should the user decide that manual adjustment of the connection parameters is needed, then selecting "Modify" brings up the Modify Service dialog and the previous dialog "Service Properties" disappears. If the service being elected to modify is actively connected, then a warning dialog appears, notifying the user that any changes to an active service could cause loss of data. This warning dialog allows the user to cancel the modify action or continue to bring up the Modify dialog. While the user is in the modification dialog, changes can be made to any of the connection parameters, including alteration of the tab name.

**[0408]** For any service that is using any protocol other than Native ATM, the "Settings" button is enabled and brings up a configuration dialog for that protocol if selected.

**[0409]** For communicating via IP over ATM, the configuration dialog provides flexibility. A PVC connection using Routed IpoA allows using the gateway IP address already configured in the TCP/1P protocol stack as the destination machine to connect to in the Ethernet LAN. If the connection is a machine other than the gateway, then the user needs to provide the IP address of that machine to complete the connection. This configuration is simplified by the use of SVC's or Bridged IpoA.

**[0410]** The ATM Interface dialog displays global performance data and configuration setting to the user (See Figure 13). This dialog was intended to be used for providing ISP's with configuration information in the event that a service installation failed or was working improperly. The connection status information is static and cannot be altered by the user in this application.

**[0411]** The Tabs that display modem performance are initially set to as blocked--i.e. not being displayed, since they were intended for the advanced user to use for troubleshooting communication problems. The option is checked on the options tab in order to display it. This causes the dialog to appear as shown in Figure 15.

**[0412]** The data contained on these dialogs is that which is specified to be supplied by the Copperhead Specification. The only added feature is the ability to connect and disconnect the modem manually from this dialog.

### 5. Help

**[0413]** All dialog windows have both context sensitive help - "?" in upper right corner - and F1 help or "Help" button controls. Context sensitive help allows the user to left mouse click the "?" and then click on the control that help is needed for to get a popup help window. This help is generally very short and concise. If more detailed help is needed the user can select the F1 key on the keyboard or the "Help" button if present.

**[0414]** This embodiment also operates using firmware running on a ARM7TDMI RISC processor, and using the HYDROGEN chipset from ATML. The Hydrogen firmware, as described herein, also includes download software, control information passing, and POST initiation.

**[0415]** The present disclosure uses the ATMos operating system provided by ATML. This operation system runs the functional blocks shown in Fig. 49. Figure 50 shows the download process.

**[0416]** The Boot loader module 4900 is actuated whenever power is applied to the HYDROGEN chipset, or the reset pin is asserted. The HYDROGEN chipset has minimum boot loader code embedded in the internal boot ROM. Part of this embedded code is an ARM block that has two boot ROM codes.

**[0417]** This embodiment selects ROM2 to boot from serial PROM 412 at step 5000. A sub-vendor ID is included in the serial PROM that sets the configuration register. The boot loader waits for a code download complete bit set by the host into the mailbox register. This 12 byte code is factory preprogrammed into the serial boot ROM.

**[0418]** The PC power on selftest ("POST") code then performs configuration at Step 4902 to allow access into the HYDROGEN chip. During the PC operating system load, e.g. Win95 or NT, the NIC driver downloads code at step 5002 to the 8-Kbyte internal SRAM of the HYDROGEN starting at location 0x00004000. The code is downloaded through the I/O window assigned during PCI configuration.

**[0419]** After the NIC driver finishes the code download, a bit in the Mailbox register is set by an I/O write at 4904 to a location assigned during PCI configuration. The HYDROGEN then begins execution starting at 0x000040000.

**[0420]** The downloaded codes are divided in a two-step process.

**[0421]** The first downloaded code or HYDROGEN POST code shown at 5004 includes:

- HYDROGEN power-on self test
- HYDROGEN self-Initialization
- HYDROGEN DRAM sizing and check
- ASIC interface check
- Other interface checks e.g. SACHEM & UTOPIA

**[0422]** The POST result is stored at a location for further retrieval. The code then resets the download complete bit at the mailbox register and waits for the bit set again by the host.

**[0423]** The second downloaded code 5006 includes at least the following components:

- ATMos Operating System
- ATM code
- Additional codes to the i960 processor DRAM allowing full access into the i960 memory address while the i960 is still in reset. This enables DMA while the processor is reset.

**[0424]** Since the HYDROGEN is a PCI device, it is configured by the POST code during the PCI Device Scan. This assigns resources such as memory, I/O, and interrupt. The POST BIOS dynamically configures and assigns memory, I/O and interrupt resources to the HYDROGEN using Configuration Mechanism One that uses two 32-bit I/O ports located at addresses 0CF8h (CONFIG - ADDRESS) and 0CFCh(CONFIG - DATA). The 0CF8h and 0CFCh registers are used to access into the 64 byte header of the PCI Configuration Registers in the HYDROGEN.

**[0425]** After the configuration, the memory is configured as shown in Figure 51.

a the 64 byte header 5100 at offset 010h has the memory base address of the 16K memory window used by the NIC window virtual driver to access into the HYDROGEN memory space.
b The 64 byte header 5102 at offset 014h has the I/O base address of the 64 byte window used by the NIC driver to access the HYDROGEN internal registers.
c The 64 byte header at offset 050h has the PC interrupt number(#0h- #0Fh) assigned to this device.

**[0426]** The HYDROGEN chip allows a fixed 16K memory space and 64 byte I/O space access. The values and offsets are defined in the HYDROGEN Data Book.

**[0427]** The sequences of code download on power upon reset are as follow. First, the HYDROGEN and i960 are held in reset at 5200. Then, the system downloads HYDROGEN POST binary at 5204 and waits for POST result. At 5206, a timeout error is established after

1-2 seconds. Step 5210 shows downloading the i960 processor Long or Normal POST binary via the mailbox. Step 5212 monitors for the POST result. The system waits up to X seconds at 5214 for the POST result to be read back from the i960 mailbox. The POST result is 4 bytes = 32 bits long with the LSB read first. This 32 bit POST result will allow up to 32 different codes if used as a bitmap, or 2^32 different codes if used as a number. The POST code is written to an address in the numbers Registry name, at 5216 so that the Service Monitor can read the POST code later.

**[0428]** The i960 processor Main binary is downloaded via the mailbox at 5218. Step 5220 downloads the HYDROGEN Main binary. A DMA code is downloaded (5006) that allows access into the memory even though the processor remains in reset. After these downloads are complete, the HYDROGEN is released from reset at 5222, followed by releasing i960 from reset at 5224.

**[0429]** Steps 5216 and 5218 require 4 new registry names to be created by the install script. These include the i960 POST filename; the i960 POST wait time (X seconds at 5214); the POST result code; and the i960 Main filename.

**[0430]** The Long or Normal i960 POST is selectable by users [add] and the registry names are updated accordingly. Currently, the wait time for the normal POST is 2 seconds and for the Long POST is 2 minutes.

**[0431]** The return code has a one byte unique prefix (0x5A) follows by a 32 bit mapped hex code as shown from first in time to last in time on the report.

| | b3 I -b24 | b23-b16 | b15-b8 | b7-b0 |
|---|---|---|---|---|
| Ox5A<br>1 byte | MSB only<br>1 byte | Unused<br>1 byte | Sachem<br>1 byte | i960<br>1 byte |

**[0432]** In general, a bit value of 0 denotes test pass and a bit value of 1 denotes test fail, except for bit 31.

**[0433]** The normal POST return Code is 0x00000000 meaning there is no errors.

**[0434]** POST return code bit map detail:

b31: always 0 to denote this is a NORMAL POST result
b30-b 12: Not Used (value = '0').
b11: Sachem UTOPIA cell loopback configuration.
b10: Sachem Config registers 0x22 and 0x24 return 0 after reset. b09: Sachem general registers read and write test.
b08: Sachem version register return expected value.
b07: i960 timer0 interrupt test.
b06: Unused
b05: i960 DRAM 16bit read and write test.
b04: i960 DRAM 8bit read and write test.
b03: i960 DRAM 32bit read and write test.
b02: i960 DRAM burst read test.
b01: i960 DRAM burst write test.
b00: i960 DRAM bit read and write test.

**[0435]** All other bits are unused and should be returned as 0. Long POST return code: 0x80000000 (No error) POST return code bitmap detail:

b31: always 1 to denote that this is a LONG POST result
b30: Not used (value = '0').

b29: Not used (value = '0').
b28: Not used (value = '0').
b27: Not used (value = '0').
b26: Not used (value = '0').
b25: Not used (value = '0').
b24: Not used (value = '0').
b23: Not used (value = '0').
b22: Not used (value = '0').
b21: Not used (value = '0').
b20: Sachem Interrupt Test Success.
b19: Not used (value = '0').
b18: Not used (value = '0').
b17: Sachem internal RAM test success.
b16: Sachem internal RAM test completion.
b15: Not used (value = '0').
b14: Sachem all registers 0xAA read and write test.
b13: Sachem all registers 0x55 read and write test.
b12: Sachem all registers reset value test.
b11: Not used (value = '0').
b10: Sachem single register 0xAA read and write test.
b09: Sachem single register 0x55 read and write test.
b08: Sachem single register reset value test.
b07: i960 timer0 interrupt test.
b06: Not used (value = '0').
b05: i960 DRAM 16-bit read and write test.
b04: i960 DRAM 8-bit read and write test.
b03: i960 DRAM 32-bit read and write test.
b02: i960 DRAM burst read test.
b01: i960 DRAM burst write test.
b00: i960 DRAM bit read and write test.

**[0436]** The HYDROGEN and the NIC driver interface through the PCI bus.

**[0437]** The accesses into the HYDROGEN internal memory location(AD[b31 -bO]) including internal registers are through an I/O-mapped window. All data transport is via the HYDROGEN DMA channel. The 16K memory-mapped window is not used by the HYDROGEN.

**[0438]** The PC-NIC virtual driver initialization routine first obtains the I/O base address and interrupt number from port 0CF8h and 0CFCh. Another way to retrieve this information is by using software interrupt 1Ah with function code 0B1h in the AH register and the appropriate sub function code in the AL register. The PCI BIOS documentation provides a complete description of each function call.

**[0439]** The physical I/O base address is then mapped into the window virtual port address. Once the base address is obtained, the PC-NIC driver uses the _inpd() function to read/write to the following three 32-bit registers: I/OARMAddress at offset 00, I/OARMData at offset 04, and I/O MailBox at offset 08.

**[0440]** The combination of the I/O base addresses at offset 00 and 04 allows the PC-NIC driver access into the HYDROGEN space. The interrupt number allows the PC-NIC driver to chain its interrupt service routine into the appropriate PC interrupt vector table. The interrupt routine then services the interrupt generated by the INTA pin from the HYDROGEN chip.

**[0441]** The I/O base address at offset 08 is used for interrupt handling. The HYDROGEN Data book provides more information.

**[0442]** The transmit and receive DMA transport/communication data are handled through the DMA engine in the HYDROGEN's LIST Manager hardware.

**[0443]** I/O Access is handled via the PCIbus, into the HYDROGEN. For clarity, an example of a 64 byte header at offset 014h = 0B0A00000h is used. This I/O access is used for all command/response communication between the PC application to the PCIbus, and to the HYDROGEN. This may be directed to the ARM, i960, or SACHEM. The I/O access is also used initially to download HYDROGEN codes into the internal RAM(8K) and the external RAM(1M).

**[0444]** I/O base address + offset 00 store the full 32 bit of HYDROGEN address.

**[0445]** The I/O base address + offset 04 store the data R/W from/to the HYDROGEN address.

**[0446]** Sample code:mov dx, #0B0A00000h ;load I/O base address w/off00

```
    out dx, #10000200h ;write LMSR addr to I/O addr
```

```
mov dx, #0B0A00004h ;load I/O base address w/off04
in eax, dx ;read the content of LMSR
mov eax, #0000AA55h ;or
out dx, eax ;write dword to the LMSR reg
```

**[0447]** An interrupt from the PC-NIC driver to HYDROGEN is used primarily for commands/responses to/from communication. There are four PCI MailBox registers (b5-b2) at the I/O base address with offset 08h. The PC-NIC driver sends data from the PC to this mailbox at 5300. These mailboxes can be read from/written to by the PC-NIC driver to interrupt the HYDROGEN chipset at 5302. Currently, one of the PCI MailBox interrupts is used by the PC-NIC driver to generate a PCILO interrupt to the HYDROGEN.

**[0448]** I/O base address + offset 08h in b5-b2 is used to access the PCI MailBox register. The MailBox register interrupt is to signals the HYDROGEN to start executing the downloaded code at 5304.

```
mov dx, #0B0A00008h
in eax, dx ; read the PCI mailbox register
or eax, #80h ; set maibox 0 bit
out eax, dx ; write to PCI mailbox register
```

**[0449]** Communication data transport and access into the PCI space can also be via the HYDROGEN DMA engine as shown in Figure 54. In addition, The ARM MailBox register at location 0x10000808 is used to generate/clear interrupts to/from the PCI.

**[0450]** The data transport DMA operation is handled by the hardware List Manager in the HYDROGEN chip once set up. This requires little or no intervention from the ARM processor.

**[0451]** The command/response to/from the PCI is handled by the ARM processor by setting the appropriate List Manager registers for: to address, from address, size of data, and the enable DMA bit at 5400.

**[0452]** An interrupt from the HYDROGEN to the PC-NIC driver is used primary for commands/responses to communication. The ArmMailBox register is set at address 010000808h, as seen from the HYDROGEN. There are four mailboxes at this location that can be read from or written to the HYDROGEN to interrupt the NIC driver. The interrupt is generated by INTA pin. Currently, one of the ARM Mailbox interrupts is used by the HYDROGEN to generate an interrupt to the NIC driver.

**[0453]** After the DMA operation at 5402, the ARM processor normally sends an interrupt to the PC at 5404 by setting the appropriate bit on the ARMMailBox register. In the same manner, when the ARM processor receives the PCI_LO interrupt from the PC, the PCI data is read into the ARM data by using DMA, then clearing the interrupt bits in the ARMMailBox. The 'to' and 'from' addresses (slots) of both the ARM& PCI are set during the driver and HYDROGEN firmware initialization routine.

Software API

**[0454]** An Application Program Interface (API) between the HYDROGEN and the PC application allows the HYDROGEN to communicate with the PC. The ATMSOCK socket services are used to communicate with the PC-NIC driver. The PC-NIC driver code then passes the request to the HYDROGEN through the PCI bus, using DMA and the mailbox interrupt. Most of the communication to/from the HYDROGEN has been implemented by ATML using ATMSOCK. Any additional communication (specific to ADSL or other) to/from HYDROGEN/ASIC/i960 is implemented with new socket services or modified existing socket services.

**[0455]** The API includes a Modem Control Interface, and a Hydrogen Control Interface. The Current Implementation uses ATMSOCK.

**[0456]** Figure 54 illustrates the command/response flow from the very top level software to the HYDROGEN.

**[0457]** From the very top level, the PC application opens an ATMSOCK socket service at 5400. The request is passed into the HYDROGEN code via the PC-NIC driver at 5402. The HYDROGEN responds by opening a corresponding ATM socket service process(AIF_SOCKS) at 5404. Here, the PC is the socket client and the HYDROGEN is the socket server. The socket client then requests a sub-service to be connected at 5406 using the socket opened. Current supported subservices include SNMP, used by Vstatus, and VCONS, used by Vcons.

**[0458]** Once the service is established and active, the PC application makes calls into the HYDROGEN code at 5408. At the PC-NIC driver level, all the socket-called-data-format are written into a specific pre-allocated PC memory and followed by a PCI mailbox interrupt into the HYDROGEN. The HYDROGEN PCILO ISR then posts a wakeup message to the PC-DDI process in the HYDROGEN. The PC-DDI process then reads the call's data format from PC space into HYDROGEN space by using DMA. The HYDROGEN processes the call's format and makes the appropriate sub-service calls.

**[0459]** Modem Control Interface API uses a new sub-service call CTRL-ADSL. An existing socket(AIF_SOCKS) is used. CTRL-ADSL uses the following definitions and mnemonics:

```
#define AF_HAYES_ADSL (1375)
```

**[0460]** The VCONS source code is a base code for implementation.

**[0461]** The PC application sends a command to the HYDROGEN at 5408 with the function call send (socket number, command string, length in bytes, 0). Analogously, the PC application receives the response at 5410 with the function call recv (socket number, return buffer, length in bytes, 0).

**[0462]** The complete HOST Commands as described in the management specification herein are passed to the HYDROGEN as part of the command string. The format for the command passing parameters are as follows:

| Destination address | Source | Command opcode | Length of data. N bytes | N data bytes |
|---|---|---|---|---|
| 1 byte | 1 byte | 1 byte | 1 byte | N bytes |

**[0463]** Destination address: An unsigned character 0-255 for this request intended to. For the management application in the i960, the value for this byte is 0x 10.

**[0464]** Source address: An unsigned character 0-255 showing the originator of this command. For the PC application in the Host, Like Service Monitor, the value for this byte is 0x01.

**[0465]** Command opcode: An unsigned character 0-255 command opcode.

**[0466]** Length of data. (N bytes): An unsigned character 0-255 indicating if additional data bytes are present. N data bytes: If the previous byte is non zero, there will be N more data bytes.

**[0467]** The PC-DDI process in the HYDROGEN runs an endless loop to constantly check for any call back or response socket services in the queue to be sent back to the PC. The queue is being added by other active socket service processes that are running. The PC-DDI process passes the socket response data format into the PC space DMA followed by an ARM mail box interrupt into the PC. The PC-NIC driver then reads the data and passes the data up the corresponding PC application that owns the socket services.

**[0468]** The return buffer format is very similar to the command string except that the source and destination addresses are swapped.

**[0469]** The "length of data bytes follow" field is usually greater than 1 to hold the response data, which can be 1-255 bytes.

Hydrogen Control Interface (0x20) - Commands

Table 1 lists the Host commands that the Host may issue to the Hydrogen.

Table 1.

| Host Commands | | | |
|---|---|---|---|
| **Command** | **Opcode** | **Date Field Length** | **Data Field Contents** |
| Open PVC connection | 0x01 | Variable | ASCII textstring |
| Close PVC connection | 0x02 | 4 | Binary vpivci |
| Get PVC performance data | 0x03 | 4 | Binary vpivci |
| OAMF4 enable(1)/disable(0) | 0x04 | 1 | BOOL 1 or 0 |
| OAMF5 enable(1)/disable(0) | 0x05 | 1 | BOOL 1 or 0 |
| Get Global statistic counters | 0x06 | 0 | - |
| Get Hydrogen Version | 0x07 | 0 | - |
| Get Hydrogen Vendor | 0x08 | 0 | - |
| Get MAC Address | 0x09 | 0 | - |
| Add NATM Connection<br>Remove NATM Connection<br>Reports ADSL Line Sync | 0x0A<br>0x0B<br>0x0C | Variable<br>4<br>1 | ASCII textstring<br>Binary vpivci<br>BOOL 1 or 0 |

**[0470]** Open PVC Connection

**[0471]** The Data fields content have the following ASCII format:

Classical IP example:

"proto:pipa/ip:192.120.60.35/vpi:32/vci:110/pcr:3622/class:cbr" RFC1483 example:

"vpi:255/vci:65535/pcr:500/class:ubr/encap:llcs"

**[0472]** The above strings terminate with a NULL character. The ordering of each key field is important. The ranges of the above key values are as follows:

0<= vpi/vpi <= 255
0 < vci/vci <= 65535
xxx < pcr < 3622
aaa < scr < 3622
class: cbr, vbr, abr, ubr, ub+
encap: llcs, vcmx, null

Data Field length = strlen(above string)

### Close PVC Connection

**[0473]** The Data field contents has one 32-bit binary value of the vpi-vci that needs to be closed.
32-bit vpi-vci

```
b31        b15              b0
00    vpi      Vci     vci
```

### Get PVC performance data

**[0474]** The Data field contents will have one 32-bit binary value of the vpi-vci.
32-bit vpi-vci

```
b31          b15              b0
00     vpi       Vci     vci
```

### OAMF4 Enable/Disable, OAMF5 Enable/Disable

**[0475]** The Data field contents have one byte data value of either 1 (enable) or 0(disable).

### Get Global Statistic Counters, Get Hydrogen Version, Get Hydrogen Vender, Get MAC Address

**[0476]** No parameters required.

### Add NATM Connection

**[0477]** The Data fields content have the following ASCII format:

"vpi:255/vci:65535/pcr:500/class:ubr"

**[0478]** The above strings terminate with a NULL character. The ordering of each key field is IMPORTANT.

**[0479]** The ranges of the above key values are as follows:

0<= vpi/vpi <= 255
0 < vci/vci <= 65535
xxx < pcr < 3622
class: cbr, vbr

Data Field length = strlen(above string)

**[0480]** The above commands cause the HYDROGEN to add the connection parameters to the NATM table. No physical connection is established. The table list will be used to qualify if a subsequent open NATM connection is allowed.

### Del NATM Connection

**[0481]** The Data field contents have one 32-bit binary value of the vpi-vci that needs to be removed.
32-bit vpi-vci

```
b31              b15               b0
00     Vpi         Vci      vci
```

**[0482]** The above command removes the corresponding entry from the NATM table. No physical connection is closed.

### Report ADSL Line Sync

**[0483]** The Data field contents have one byte data value of either 1 or 0.
1 is ADSL Line Synchronization has been established.
0 is ADSL Line Syncronization has not been established or failed

### Hydrogen Control Interface (0x20) - Responds

**[0484]** Table 2 lists the response from Hydrogen to the Host commands in Table 1.

Table 2

| Host Response | | | |
|---|---|---|---|
| **Response** | **Opcode** | **Data Field Length** | **Data Field Contents** |
| Open PVC connection | 0x01 | 1 | See return code |
| Close PVC connection | 0x02 | 1 | See return code |
| Get PVC performance data | 0x03 | 32 or 1 | Binary |
| OAMF4 enable(1)/disable(0) | 0x04 | 1 | See return code |
| OAMF5 enable(1)/disable(0) | 0x05 | 1 | See return code |
| Get Global statistic counters | 0x06 | 16 | Binary |
| Get Hydrogen Version | 0x07 | Variable | ASCII text |
| Get Hydrogen Vendor | 0x08 | Variable | ASCII text |
| Get MAC Address | 0x09 | 6 | binary |
| Add NATM Connection | 0x0A | 1 | See return code |
| Remove NATM Connection | 0x0B | 1 | See return code |
| Report ADSL Line Sync Ack | 0x0C | 1 | Binary 0 |
| Unsolicited Messages | 0xFE | 1 | Binary |

### Open PVC Connection

**[0485]** Return codes:

0 Success.
1 Connection already opened and is currently active.
2 Cannot open connection, exceed maximum connections.
3 (3 & above) Error opening connection.

**Close PVC Connection**

**[0486]** Return codes:

0 Success.
1 No such active connection, cannot close.
2 Connection already closed

**Get PVC performance data**

**[0487]** If this fails, the Data field length will be 1 and the Data field contents will have 1 byte return code:

1 No such active connection, data not available
2 Current connection is not active, data not available

Otherwise, the Data field length will be 32 and The Data field contents will have 6 32-bit words as follows:
First in time:

VPIVCI (32-bit)
Total number of good data bytes transmitted for this PVC (32 bit)
Total number of good data bytes received for this PVC (32 bit)
Total number of bad data bytes received for this PVC (32bit)
Total number of received cells count discarded for this PVC (32bit)
Total number of received packets good for this PVC (32 bit)
Total number of received packets bad for this PVC (32bit)
Time stamp of this command being polled, in seconds (32 bit)

- Good data bytes transmitted is the number of data bytes from the PC sent to the HYDROGEN hardware transmit queue.
- Good data bytes received is the number of data bytes send to the PC. This normally means the CRC of the data packet is OK.
- Bad data bytes received is the number of data bytes received from the network and probably due to payload CRC error, LLC/SNAP header not recognized, and others.
- Received cells counts discarded is detected at the very front end of the HYDROGEN hardware receive queue. The discard is probably due to: PTI field > 4 in the cell header or no more free buffers (data coming in too fast). 1 cell=53 bytes
- Received packets good due to payload CRC OK.
- Received packets bad due to payload CRC error, unrecognized 11c/snap, or others.

** Note 1: The data bytes counters do not include ATM cell header, trailer, or padding.
** Note 2: I packet can be 60 bytes to 1.5K bytes of data.

**OAMF4 Enable/Disable, OAMF5 Enable/Disable**

**[0488]** This will always return 0.

**Get Global Statistic Counters**

**[0489]** The Data field length will be 16 and The Data field contents will have 4 32-bit values as follows:
First in time:

Total number of transmitted cells (32 bit)
Total number of received cells good (32 bit)
Total number of received cells discarded (32bit)
Time stamp of this command being polled, in seconds (32 bit)

Note: A cell is equals to 53 bytes of data.
Received cells discarded due to: Cell header checksum bad and VCI 0 cells

### Get Hydrogen Version, Get Hydrogen Vender

**[0490]** The Data field contents is a NULL terminated ASCII text string with a length of less than 255.
The Data field length is the strlen( above text string)

### Get MAC Address

**[0491]** The Data field length is 6 and The Data field contents will have 6 bytes of MAC address.

### Add NATM PVC Connection

**[0492]** Return codes:

0 Success
1 No more free entry in the table.

### Remove NATM PVC Connection

**[0493]** Return codes:

0 Success
1 No such connection entry in the table, cannot remove

### Report ADSL Line Sync Ack

**[0494]** The Data field contents has one byte data value of 0. It always return 0

### Unsolicited Messages

**[0495]** The Hydrogen sends the following unsolicited 1 byte hex code to the Service Monitor if the following i960 errors have been detected by the HYDROGEN.
Return codes:

1 i960 mailbox not in sync yet. This unsolicited message will be sent to the Service Monitor in the event the HYDROGEN receives a command string destination to i960 and the i960 mailbox sync is not completed.
2 i960 command buffer overflow. This unsolicited message will be sent to the Service Monitor in the event the 32 bytes i960 command buffer is full, the most recent i960 command string will be discarded. Also indicating the i960 is not reading the mailbox, thus the HYDROGEN cannot send another command byte.
3 i960 response buffer exceed maximum, mailbox will be out of sync. This unsolicited message will be sent to the Service Monitor if the i960 send a response buffer greater than the maximum allocated. The mailbox will be out of sync.

### HYDROGEN/ASIC Interface

**[0496]** The ASIC registers become an external memory map I/O device to the HYDROGEN.

**[0497]** The HYDROGEN external I/O addresses access reside on the memory block from 020000000h to 03 FFFFFFFh. Only the A23 -A16 lines(or less) will be decoded by the ASIC to activate the mailbox register locations.

**[0498]** The register definition in the HWSPEC portion provide further detail. The HYDROGEN uses these registers for command/response communication to the i960.

**[0499]** The disclosed implementation of the communication includes modifying the current AIF_SOCKS process in the HYDROGEN to handle send/receive data to/from i960.

### OBC (i960) Firmware

### Operating System for the Modem Processor

**[0500]** pSOS will be used initially as the pSOS operating system code image generated and downloaded to the i960 DRAM.

### Power-on Self Test and Self-Initialization

**[0501]** At power up, the i960 is held in reset by the ASIC. After the ASIC and the HYDROGEN are initialized, the ASIC allows the HYDROGEN to gain control over the i960 bus. The HYDROGEN downloads the i960 binaries into the i960 DRAM. The ASIC then return the bus control to the i960 and releases i960 out of reset. The downloaded i960 binaries may contain the following components:

- i960 power-on self test(POST) .
- pSOS operating system image which contains the real time kernel, Board Support Package(hardware specific code), X-API, and File system
- Modem software
- Management Application code

**[0502]** When the i960 is first released out of reset, The POST code is run first and the POST result is passed back to the PC through the mailbox. When the POST result is read, the i960 is put back into reset and the second download of the i960 main binary is performed. When the i960 is released out of reset, the pSOS is run, followed by modem software and management application.

### OBC/SACHEM Interface -

**[0503]** The SACHEM becomes a memory map I/O device to the i960 processor. The address above the DRAM ( >100000h) is mapped into the SACHEM memory space. The A20-A16 lines are decoded by the ASIC to assert the CSB signal to the SACHEM.

### Host Interface Firmware

**[0504]** The ASIC implements a mailbox function for exchanging information between the i960 and the HYDROGEN. The Mailbox has transmit buffer registers(size TBD), receive Buffer registers(size TBD), Status registers. These registers become another memory map I/O device to the i960 processor. The A20-A16 lines are decoded by the ASIC to activate these registers.

**[0505]** The management application uses the mailboxes to send and receive commands/responses to/from the HYDROGEN. The i960 can receive the message by polling or interrupt.

### Interrupt -

**[0506]** A write to the transmit Buffer by the HYDROGEN causes the ASIC to generate an interrupt to the i960 (INT 1 pin). The i960 INT 1 routine reads the messages into the local buffer, clears the corresponding bit in the Status register, and sets a flag to inform the background routine to process the message.

### Polling -

**[0507]** The Status register can be checked regularly by the OBC for message full.

**[0508]** Although only a few embodiments have been described in detail above, other embodiments are contemplated by the inventor and are intended to be encompassed within the following claims. In addition, other modifications are contemplated and are also intended to be covered. For example, the present specification refers to the controller being a processor, and the PCI interface being a hydrogen chip set, other devices could alternatively be used.

## Claims

**1.** A format for asynchronous transfer mode communications, comprising:

a first class of service where information is guaranteed to be sent at a constant bit rate;
a second class of service where information is sent at an unspecified bit rate; and
a third class of service, where information is sent at a priority at an unspecified bit rate, but which has priority over said unspecified bit rate, and is sent prior to information at said unspecified bit rate.

**2.** A format as in claim 1, where said information is asynchronous transfer mode information.

**3.** A message sending system, comprising:

a memory, storing a timing slot ring including information about packets of information to be sent, said timing slot ring storing a plurality of packets of information in a specified order; and
a controller, determining a class of service of said information to be sent, said class of service being one of a first guaranteed bit rate, and a second non-guaranteed bit rate, and a third priority non-guaranteed bit rate, and storing said constant bit rate information in said timing slot ring in a way that will be transmitted first, storing second unspecified bit rate information in said timing slot ring in a way that it will be transmitted last, and storing said priority non-guaranteed bit rate information timing slot ring information in a way that where it will be transmitted before said unspecified bit rate information, but after said constant bit rate information.

**4.** A system as in claim 3, wherein said timing slot ring includes two queues, a first of which is for constant information and a second of which is for unspecified bit rate information.

**5.** A system as in claim 4, wherein said constant bit rate information is set at the beginning of said first queue.

**6.** A system as in either of claims 4 or 5, wherein said unspecified bit rate information is added to the end of said second queue, and said priority unspecified bit rate information is added to the beginning of said second queue.

**7.** A system as in claim 6, wherein said controller defines a flag that enables reading from said second queue, said flag pointing to the front of said second queue when priority unspecified information is present, and pointing to the end of said second queue when priority unspecified information is not present.

**8.** A system as in any of claims 3-6, wherein said controller operates, at a time, to first determine if constant bit rate data is present and transmitting it if so, and then determine if unspecified bit rate data is present and transmitting it if so.

**9.** A system as in claim 8, wherein said controller determines if unspecified bit rate information is present, by first determining if priority unspecified bit rate information is present and transmitting it if so, and then determining if normal unspecified bit rate information is present and transmitting it if so.

**10.** An asynchronous transfer mode system, comprising:

a connection to an asynchronous transfer mode network, sending information in a specified asynchronous transfer mode format and receiving messages in said specified asynchronous transfer mode format, said messages including cells of information with specified qualities of service, said specified qualities of service including a constant bit rate service, an unspecified bit rate service, and a priority unspecified bit rate service.

**11.** A system as in claim 10, further comprising a memory, which stores a queue of cells, said queue including constant bit rate information first, unspecified bit rate information last, and priority unspecified bit rate information between said constant bit rate information and unspecified bit rate information.

**12.** A system as in claim 10, further comprising a controller which ends data from said queue is in order.

**13.** A system as in claim 10, further comprising a memory that stores a queue, defining a pointer to said queue, said pointer defining which packet of information will be transmitted next.

**14.** A system as in claim 11, 12 or 13 wherein said queue includes a first queue for constant rate information and a second queue for unspecified bit rate information and priority unspecified bit rate information.

**15.** A system as in claim 11, further comprising a memory that stores a single queue that stores constant bit rate information in one location which is transmitted first, unspecified bit rate information in another location which is transmitted last, and priority unspecified information in a third location which is transmitted between said first and second locations.

**16.** A system as in claim 10, 11, 12, 13 or 15 wherein said connection to an ATM network further comprises a processor running a stored sequence of instructions, said sequence of instructions controlling at least storing of data and retrieval of data.

**17.** A system as in claim 16, wherein said system is an ADSL system, and further comprising an ADSL modem part.

**18.** A method of handling a transmission in a packet-driven system, comprising:

establishing a class of services associated with each packet;
determining, for each packet, if the class of service is constant service, and sending said constant service before other services;
determining if the class of service associated with the packet is unspecified service, and sending unspecified service after other services; and
determining if the class of service is priority unspecified service, and if so, sending said package before the unspecified service packets, but after the constant service packet.

**19.** A method as in claim 18, further comprising storing the data in a queue, organized by its class of service.

**20.** A method as in claim 19, wherein said queue is organized with data to be sent first being stored first.

**21.** A method as in any of claims 18, 19 or 20, further comprising detecting if the data is constant bit rate data and ) if so storing the data at a front of a first queue, detecting if the data is unspecified rate data, and if so, storing the data in a second queue.

**22.** A method as in claim 21, wherein said second queue stores with priority unspecified data before non-priority unspecified data.

**23.** A method as in any of claims 18, 19, or 20, further comprising sending data by determining data to be transmitted, determining if said data is unspecified bit rate data, and setting a pointer to said data if so.

**24.** A method as in claim 23, wherein said pointer is set to a first location for unspecified bit rate data and to a second location for priority unspecified bit rate data.

**25.** A method as in claim 24, wherein said second location is the beginning of the queue and said first location is the end of the queue.

**26.** A method as in claim 24, wherein said second location is a part of the queue which will be read first, and said second location is a part of the queue which will be read later.

**27.** A method of operating asynchronous transfer mode comprising:

defining a timing slot ring which can be used for holding constant bit rate data at a first portion thereof to be transmitted first, and unspecified bit rate data at a second portion thereof to be transmitted last; and
defining an additional class of data which has an unspecified priority bit rate, and placing said additional class of data in said timing slot ring in a location where it will be transmitted before said unspecified bit rate data.

**28.** A method as in claim 27, further comprising defining a pointer to said timing slot ring, and reading data which is located at said pointer.

**29.** A method of testing in an asynchronous transfer mode system, comprising:

defining a class of service for information packets, which is not guaranteed, but which has priority over other unspecified bit rate packages;
sending a command which causes a remote node to send back an indication of receipt, said command including information that prioritizes it as lower than constant bit rate information, but higher than unspecified bit rate information.

**30.** A method of sending information on an asynchronous transfer mode network, comprising:

defining a memory structure which can operate with asynchronous transfer mode communications with constant bit rate (CBR) communication and unspecified bit rate (UBR) communication; and
adding an additional class of service using the same memory structure as already existing for said CBR and

UBR communication.

**31.** A method as in claim 30 wherein said memory structure comprises a timing slot ring, and said using comprises defining an additional pointer to priority UBR data that enables said priority UBR data to be sent before unpriority UBR data.

**32.** A method as in claim 30 wherein said pointer points to priority UBR data at the front of a queue, and points to normal UBR data at the back of the queue.

**33.** A method as in any of claims 30, 31 or 32 wherein said system uses a single timing ring.

**34.** A method as in any of claims 30, 31, or 32 wherein the system uses two separate timing rings.

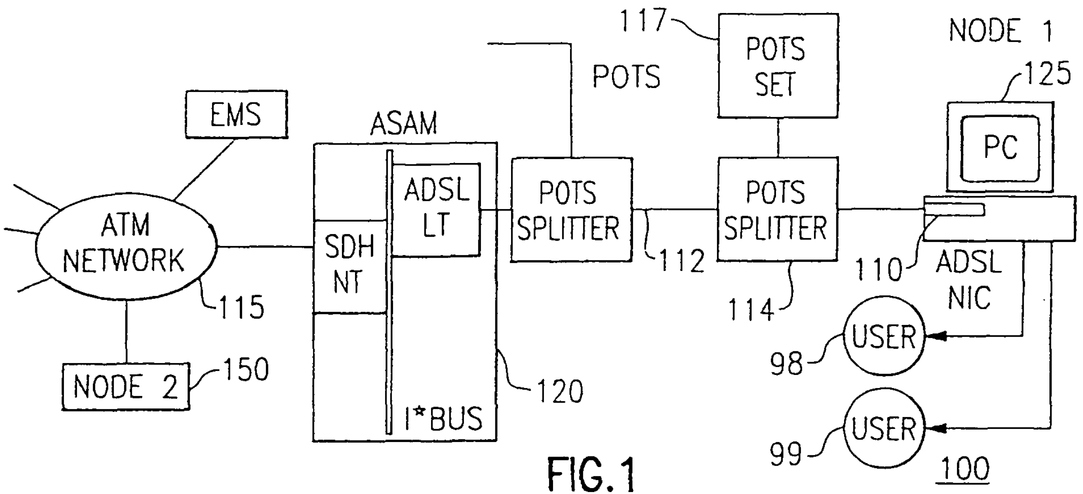


FIG.1

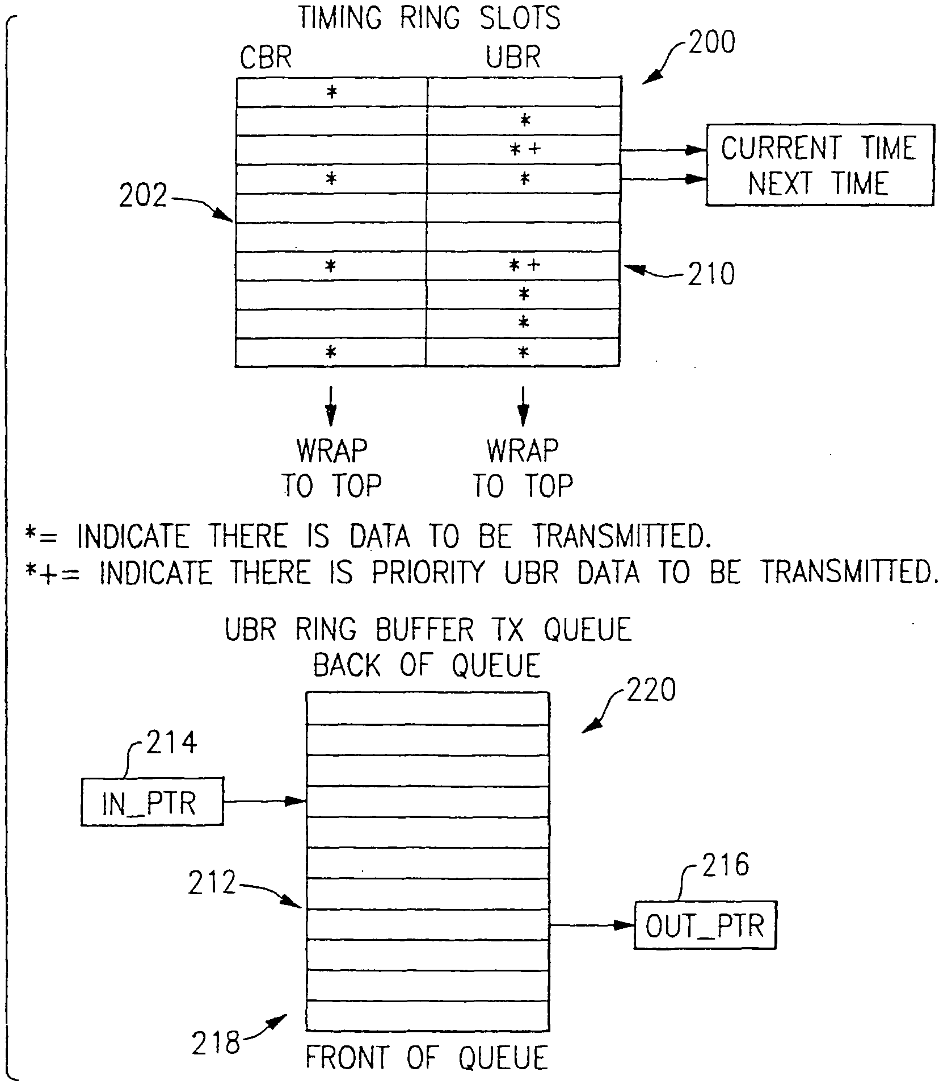


FIG.2

*= INDICATE THERE IS DATA TO BE TRANSMITTED.
*+= INDICATE THERE IS PRIORITY UBR DATA TO BE TRANSMITTED.

AMENDED SHEET

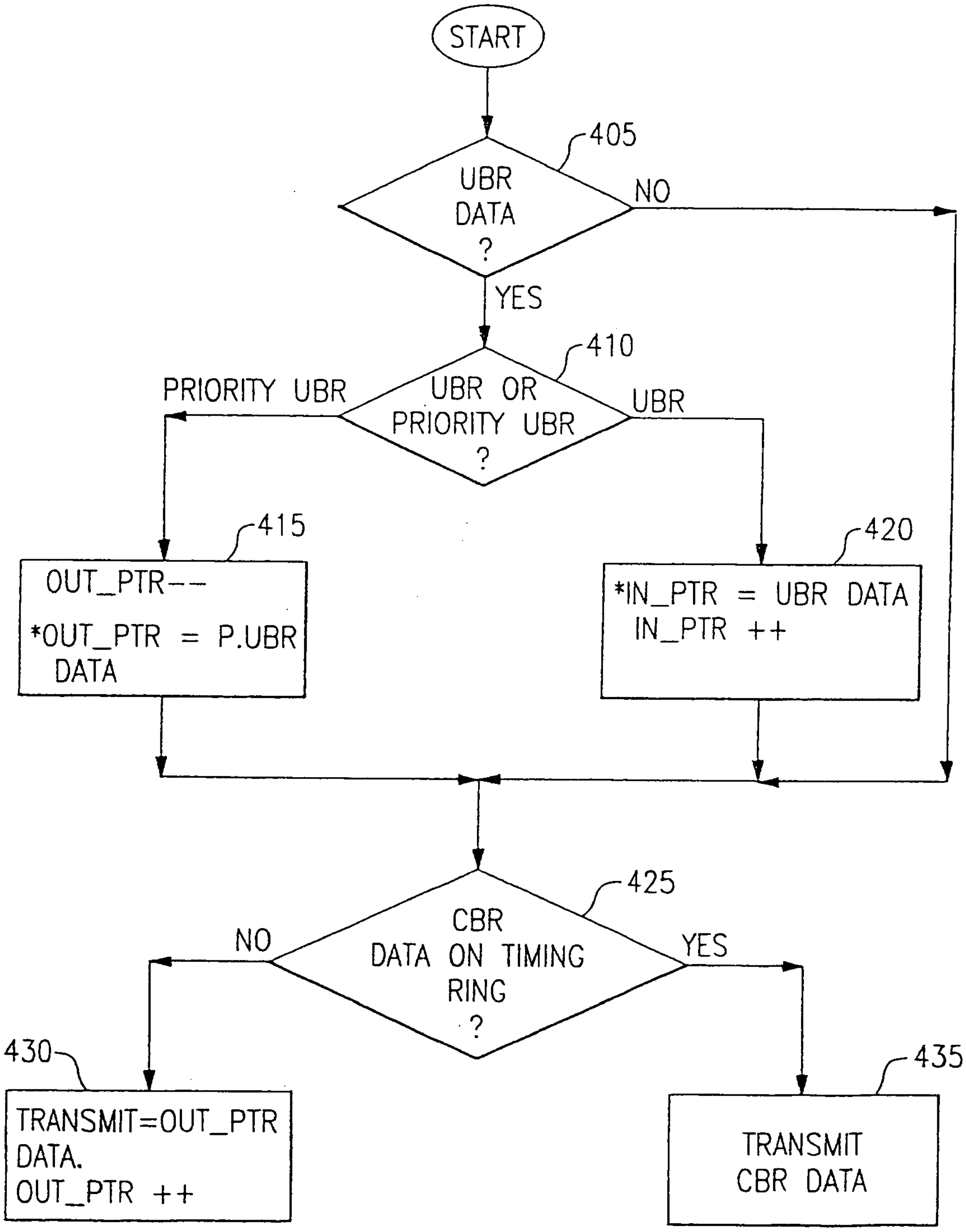

START
405
UBR DATA ?
NO
YES
410
UBR OR PRIORITY UBR ?
PRIORITY UBR
UBR
415
OUT_PTR--
*OUT_PTR = P.UBR DATA
420
*IN_PTR = UBR DATA
IN_PTR ++
425
CBR DATA ON TIMING RING ?
NO
YES
430
TRANSMIT=OUT_PTR DATA.
OUT_PTR ++
435
TRANSMIT CBR DATA

FIG.3

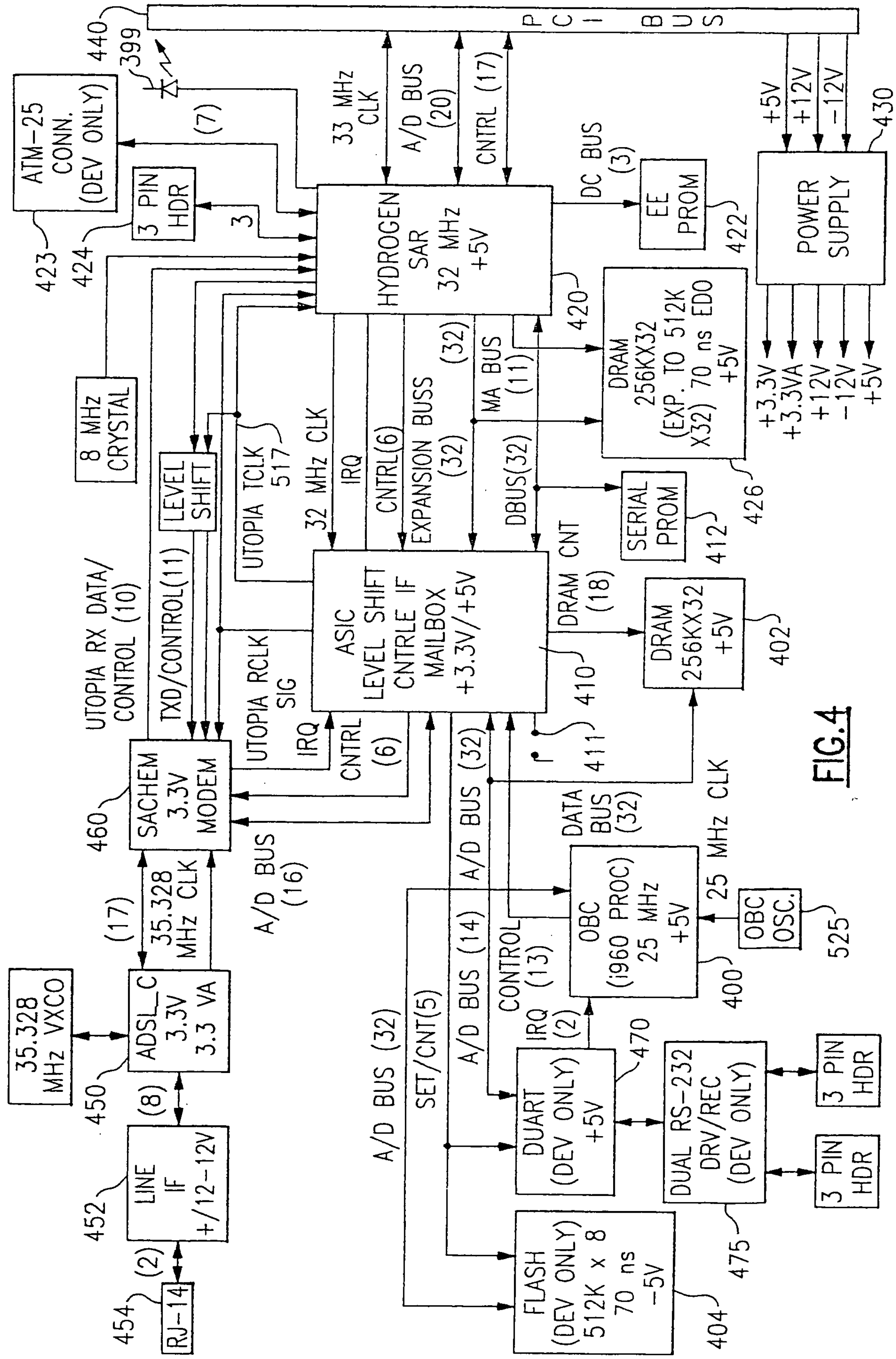

PCI BUS
440
399
(7)
ATM-25 CONN. (DEV ONLY)
423
3 PIN HDR
424
3
33 MHz CLK
A/D BUS (20)
CNTRL (17)
HYDROGEN SAR 32 MHz +5V
420
DC BUS (3)
EE PROM
422
+5V
+12V
−12V
430
POWER SUPPLY
+3.3V
+3.3VA
+12V
−12V
+5V
8 MHz CRYSTAL
LEVEL SHIFT
UTOPIA TCLK 517
32 MHz CLK
IRQ
CNTRL(6)
EXPANSION BUSS (32)
(32)
MA BUS (11)
DBUS(32)
DRAM 256KX32 (EXP. TO 512K X32) 70 ns EDO +5V
426
SERIAL PROM
412
UTOPIA RX DATA/ CONTROL (10)
TXD/CONTROL(11)
UTOPIA RCLK SIG
ASIC LEVEL SHIFT CNTRLE IF MAILBOX +3.3V/+5V
410
DRAM CNT (18)
DRAM 256KX32 +5V
402
411
UTOPIA IRQ
CNTRL (6)
A/D BUS (32)
DATA BUS (32)
25 MHz CLK
SACHEM 3.3V MODEM
460
A/D BUS (16)
(17)
35.328 MHz CLK
ADSL_C 3.3V 3.3 VA
450
35.328 MHz VXCO
(8)
LINE IF +/12-12V
452
(2)
RJ-14
454
A/D BUS (32)
SET/CNT(5)
A/D BUS (14)
CONTROL (13)
IRQ (2)
OBC (i960 PROC) 25 MHz +5V
400
OBC OSC.
525
DUART (DEV ONLY) +5V
470
DUAL RS-232 DRV/REC (DEV ONLY)
475
3 PIN HDR
3 PIN HDR
FLASH (DEV ONLY) 512K x 8 70 ns −5V
404

FIG.4

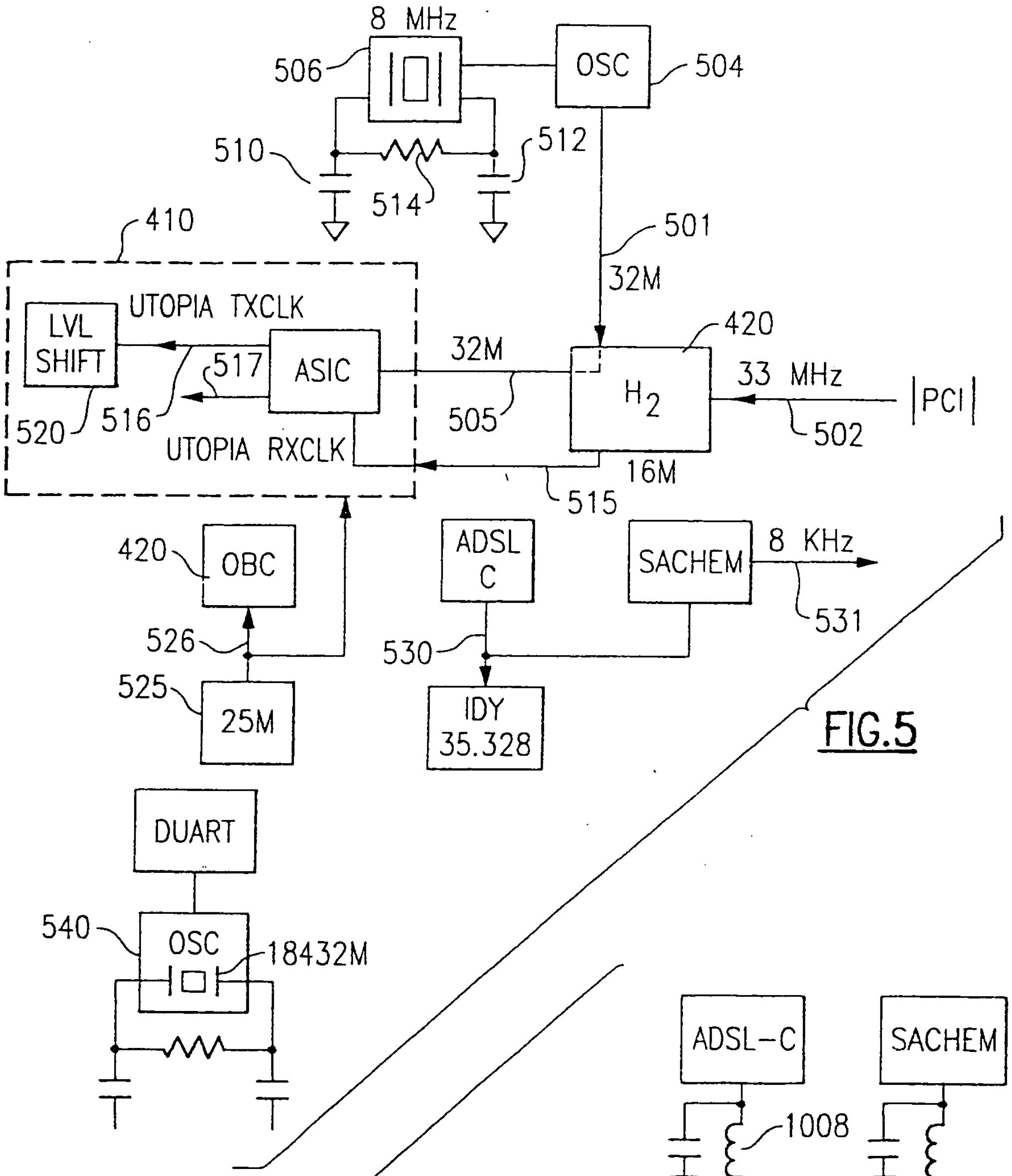

8 MHz
506
OSC
504
510
512
514
501
32M
410
UTOPIA TXCLK
LVL SHIFT
ASIC
517
32M
420
$H_2$
33 MHz
PCI
520
516
505
502
UTOPIA RXCLK
16M
515
420
OBC
ADSL C
SACHEM
8 KHz
531
526
530
525
25M
IDY 35.328
DUART
540
OSC
18432M

FIG.5

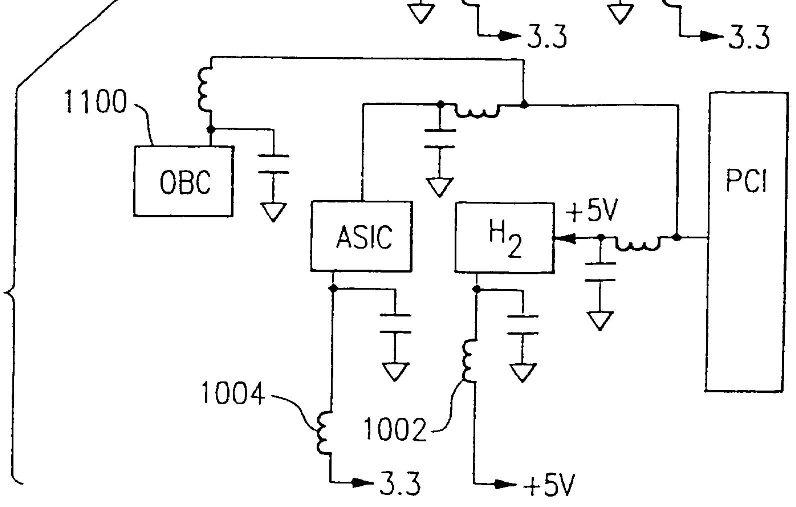

ADSL-C
SACHEM
1008
3.3
3.3
1100
OBC
PCI
+5V
ASIC
$H_2$
1004
1002
3.3
+5V

FIG.10

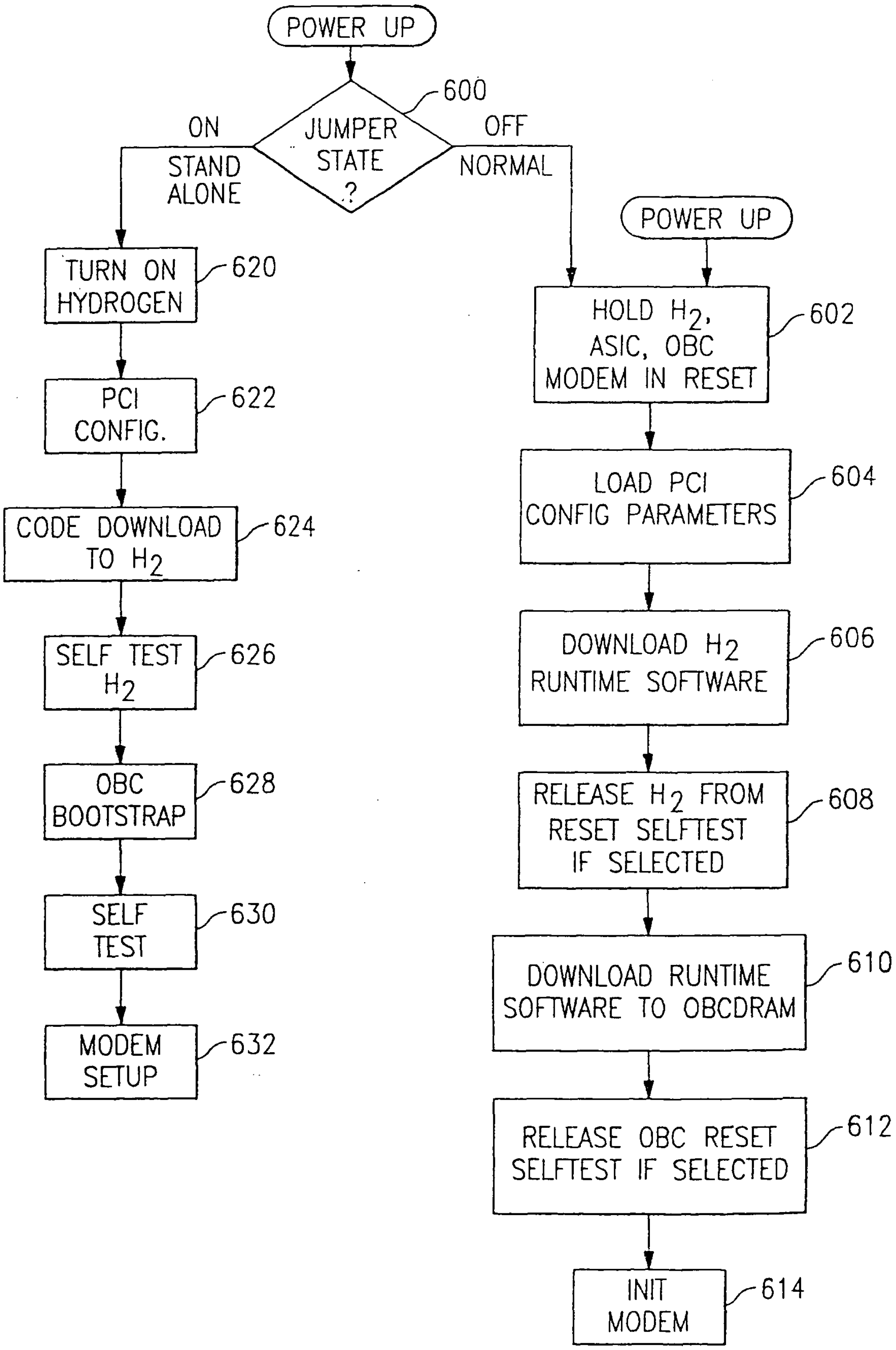

POWER UP
JUMPER STATE ?
600
ON
STAND ALONE
OFF
NORMAL
POWER UP
TURN ON HYDROGEN
620
PCI CONFIG.
622
CODE DOWNLOAD TO $H_2$
624
SELF TEST $H_2$
626
OBC BOOTSTRAP
628
SELF TEST
630
MODEM SETUP
632
HOLD $H_2$, ASIC, OBC MODEM IN RESET
602
LOAD PCI CONFIG PARAMETERS
604
DOWNLOAD $H_2$ RUNTIME SOFTWARE
606
RELEASE $H_2$ FROM RESET SELFTEST IF SELECTED
608
DOWNLOAD RUNTIME SOFTWARE TO OBCDRAM
610
RELEASE OBC RESET SELFTEST IF SELECTED
612
INIT MODEM
614

FIG.6

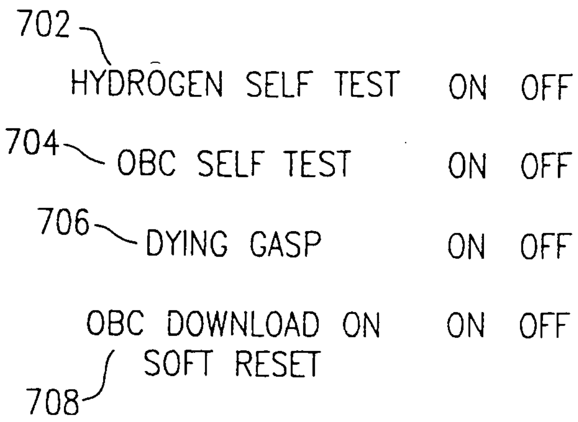

702
HYDROGEN SELF TEST ON OFF
704
OBC SELF TEST ON OFF
706
DYING GASP ON OFF
OBC DOWNLOAD ON SOFT RESET ON OFF
708

FIG.7

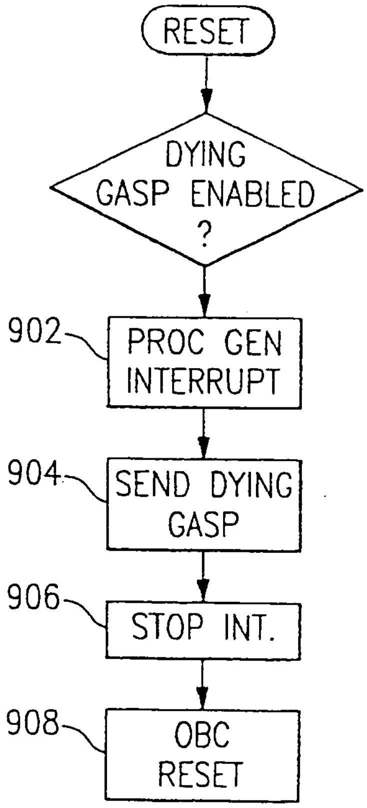

RESET
DYING GASP ENABLED ?
902
PROC GEN INTERRUPT
904
SEND DYING GASP
906
STOP INT.
908
OBC RESET

FIG.9

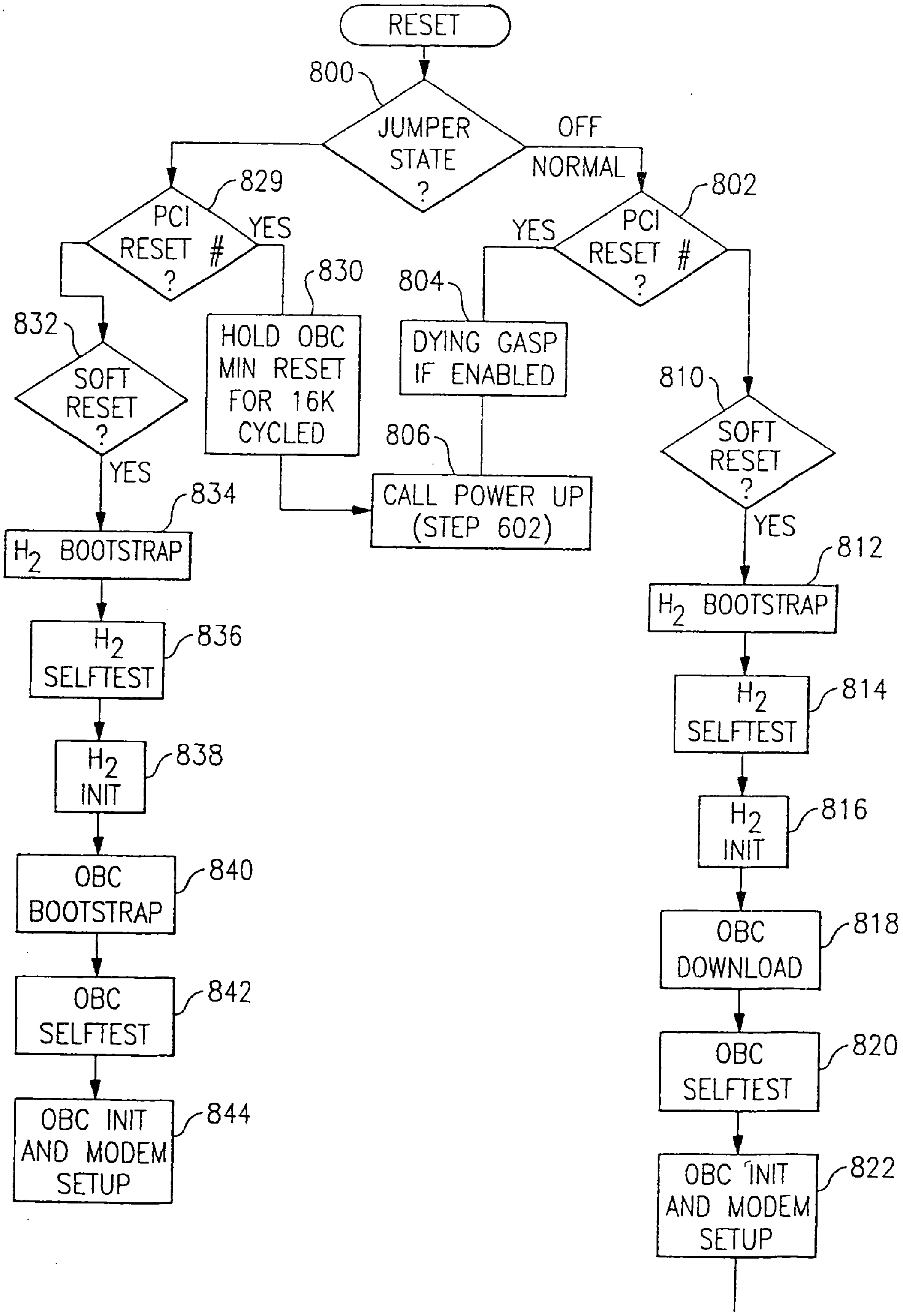

RESET
800
JUMPER STATE ?
OFF NORMAL
829
PCI RESET # ?
YES
802
PCI RESET # ?
YES
830
HOLD OBC MIN RESET FOR 16K CYCLED
804
DYING GASP IF ENABLED
832
SOFT RESET ?
YES
806
CALL POWER UP (STEP 602)
810
SOFT RESET ?
YES
834
$H_2$ BOOTSTRAP
836
$H_2$ SELFTEST
838
$H_2$ INIT
840
OBC BOOTSTRAP
842
OBC SELFTEST
844
OBC INIT AND MODEM SETUP
812
$H_2$ BOOTSTRAP
814
$H_2$ SELFTEST
816
$H_2$ INIT
818
OBC DOWNLOAD
820
OBC SELFTEST
822
OBC INIT AND MODEM SETUP

FIG.8

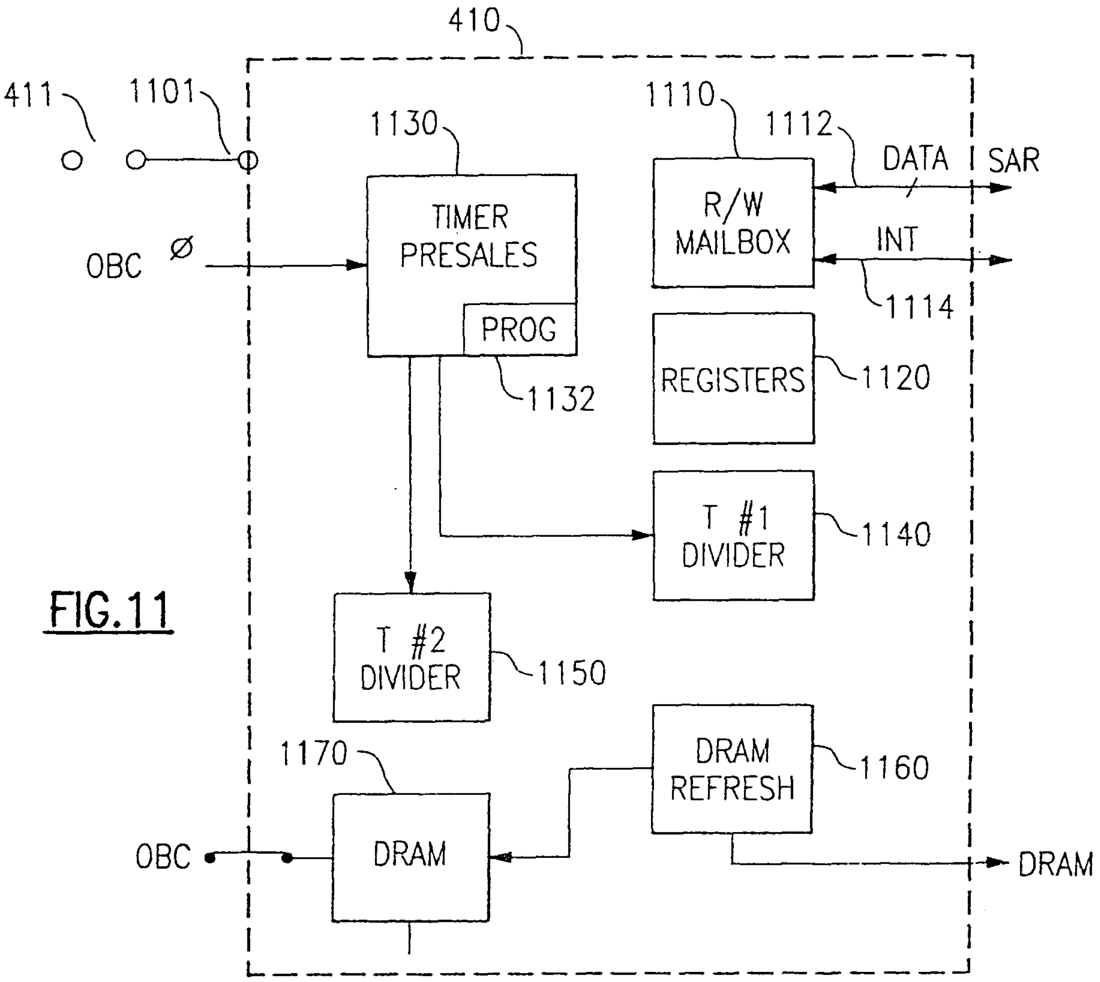

410
411
1101
1130
1110
1112
DATA
SAR
TIMER
PRESALES
R/W
MAILBOX
INT
OBC
Ø
1114
PROG
1132
REGISTERS
1120
T #1
DIVIDER
1140
T #2
DIVIDER
1150
1170
DRAM
REFRESH
1160
OBC
DRAM
DRAM

FIG.11

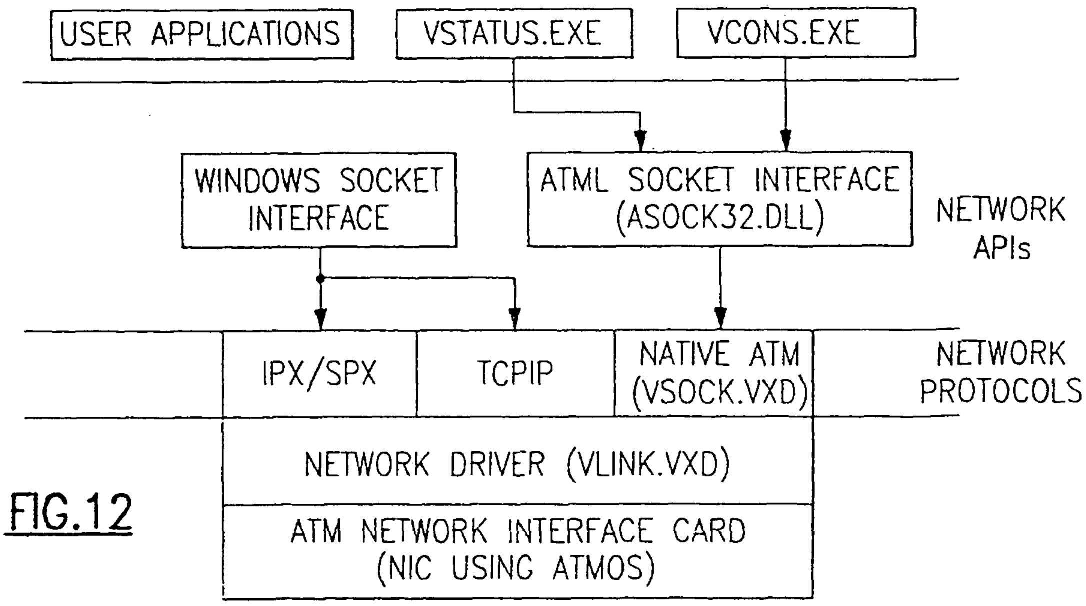

USER APPLICATIONS
VSTATUS.EXE
VCONS.EXE
WINDOWS SOCKET
INTERFACE
ATML SOCKET INTERFACE
(ASOCK32.DLL)
NETWORK
APIs
IPX/SPX
TCPIP
NATIVE ATM
(VSOCK.VXD)
NETWORK
PROTOCOLS
NETWORK DRIVER (VLINK.VXD)
ATM NETWORK INTERFACE CARD
(NIC USING ATMOS)

FIG.12

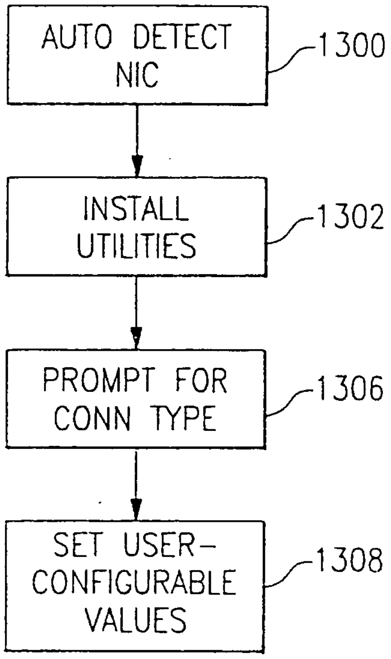

AUTO DETECT NIC
1300
INSTALL UTILITIES
1302
PROMPT FOR CONN TYPE
1306
SET USER-CONFIGURABLE VALUES
1308

FIG.13

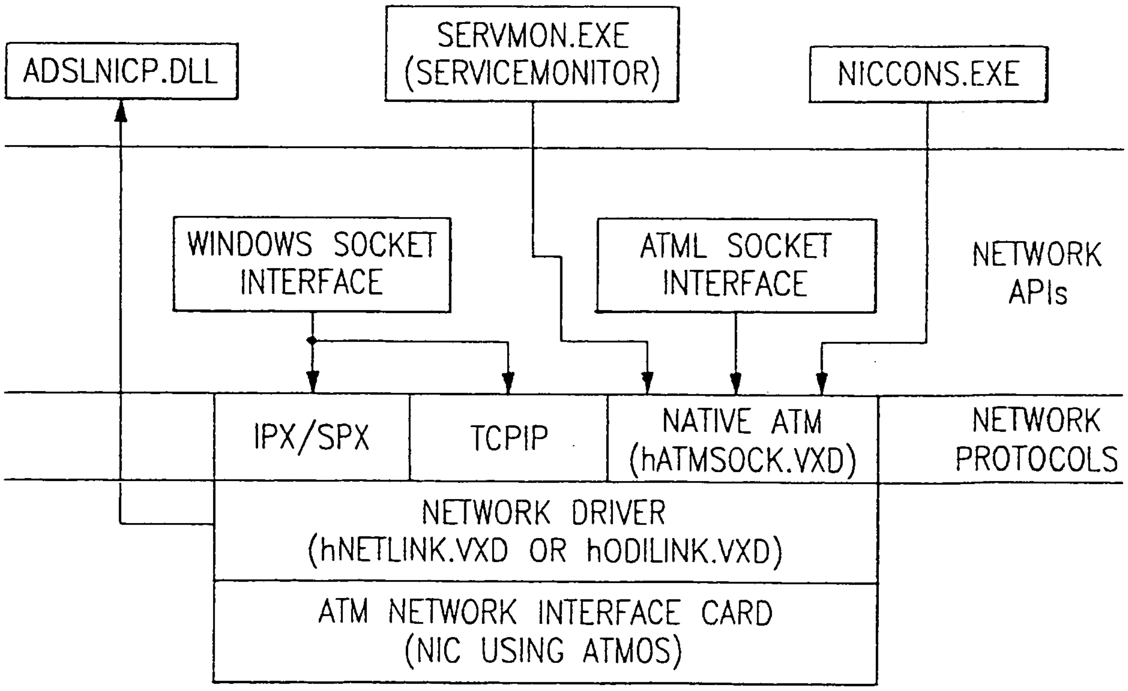
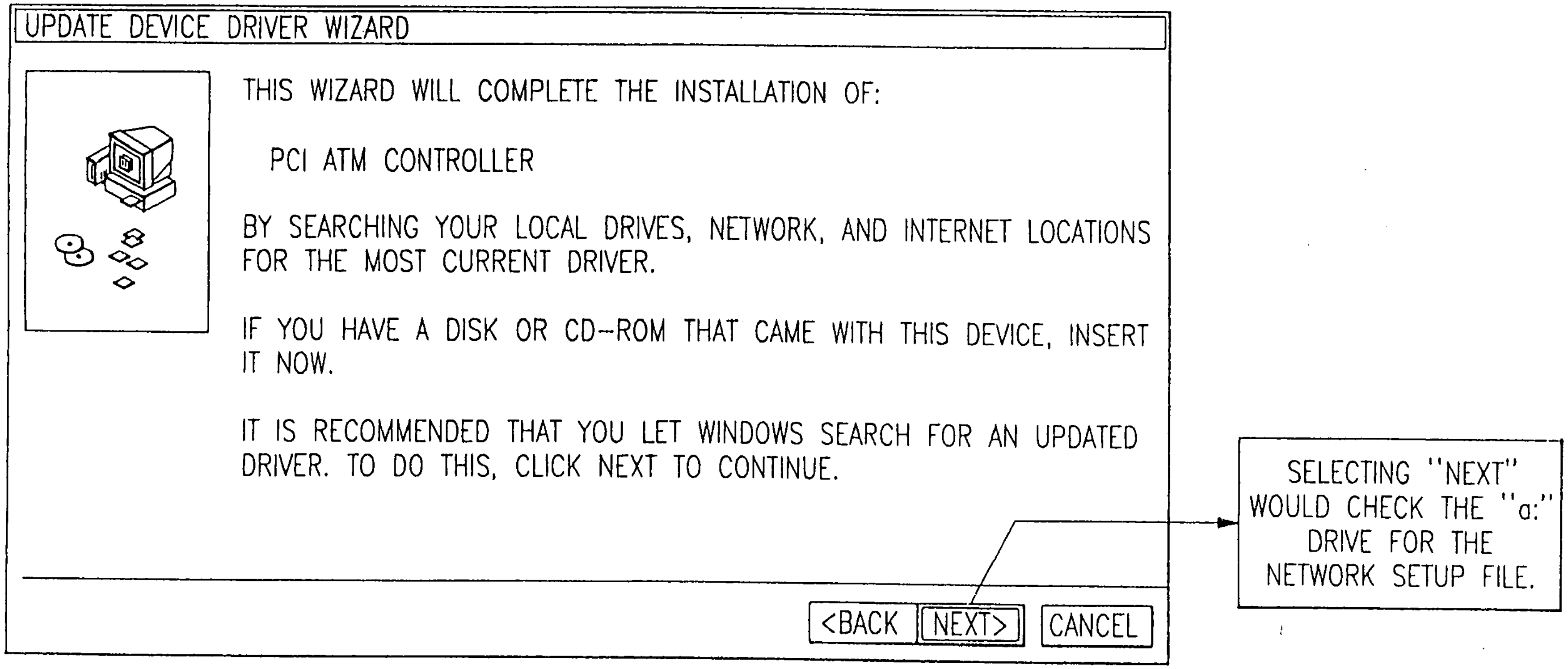

ADSLNICP.DLL
SERVMON.EXE (SERVICEMONITOR)
NICCONS.EXE
WINDOWS SOCKET INTERFACE
ATML SOCKET INTERFACE
NETWORK APIs
IPX/SPX
TCPIP
NATIVE ATM (hATMSOCK.VXD)
NETWORK PROTOCOLS
NETWORK DRIVER (hNETLINK.VXD OR hODILINK.VXD)
ATM NETWORK INTERFACE CARD (NIC USING ATMOS)

FIG.14



THIS WIZARD WILL COMPLETE THE INSTALLATION OF:

PCI ATM CONTROLLER

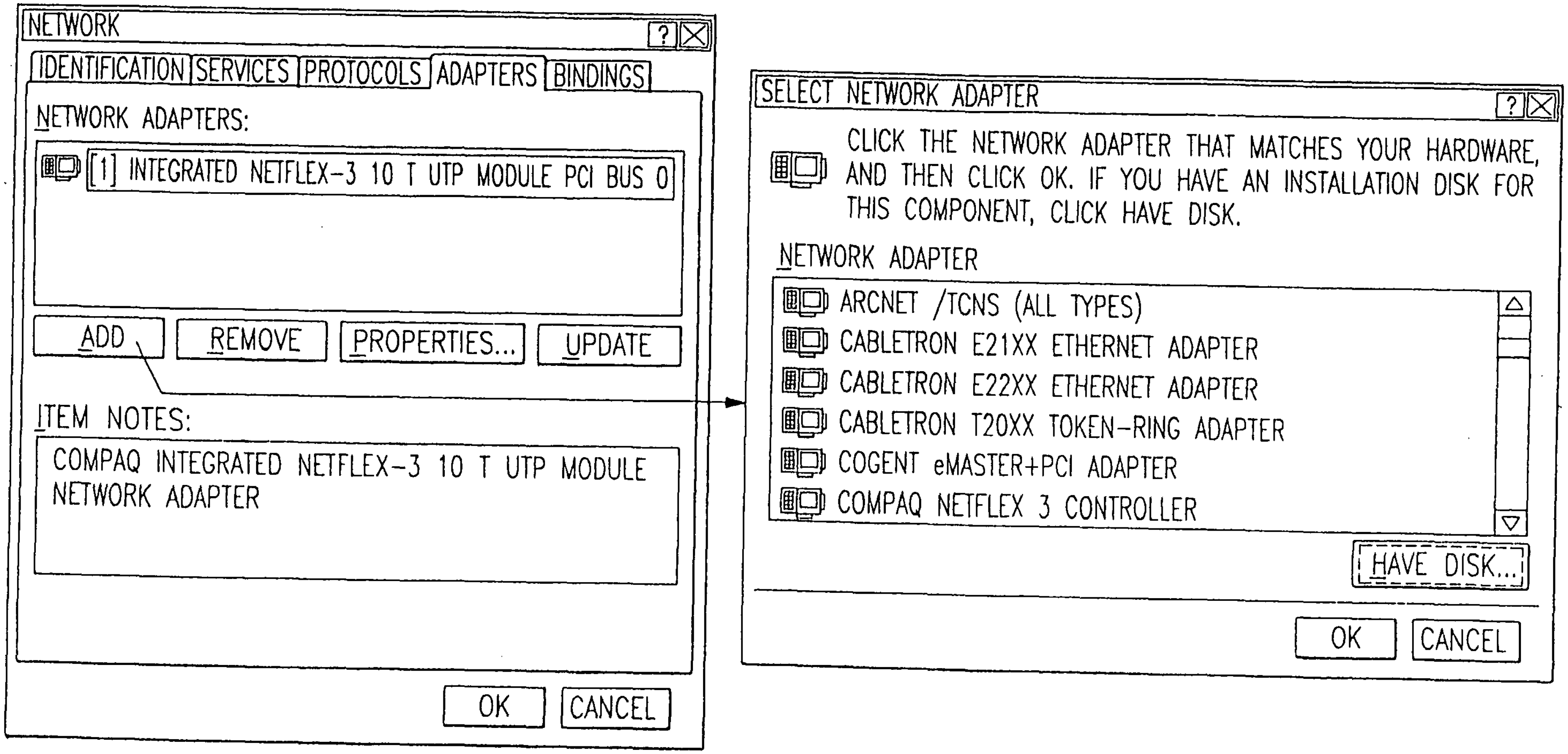
BY SEARCHING YOUR LOCAL DRIVES, NETWORK, AND INTERNET LOCATIONS FOR THE MOST CURRENT DRIVER.

IF YOU HAVE A DISK OR CD-ROM THAT CAME WITH THIS DEVICE, INSERT IT NOW.

IT IS RECOMMENDED THAT YOU LET WINDOWS SEARCH FOR AN UPDATED DRIVER. TO DO THIS, CLICK NEXT TO CONTINUE.

SELECTING "NEXT" WOULD CHECK THE "a:" DRIVE FOR THE NETWORK SETUP FILE.

FIG.15



NETWORK ADAPTERS:

[1] INTEGRATED NETFLEX-3 10 T UTP MODULE PCI BUS 0

ITEM NOTES:

COMPAQ INTEGRATED NETFLEX-3 10 T UTP MODULE NETWORK ADAPTER

CLICK THE NETWORK ADAPTER THAT MATCHES YOUR HARDWARE, AND THEN CLICK OK. IF YOU HAVE AN INSTALLATION DISK FOR THIS COMPONENT, CLICK HAVE DISK.

NETWORK ADAPTER

ARCNET /TCNS (ALL TYPES)
CABLETRON E21XX ETHERNET ADAPTER
CABLETRON E22XX ETHERNET ADAPTER
CABLETRON T20XX TOKEN-RING ADAPTER
COGENT eMASTER+PCI ADAPTER
COMPAQ NETFLEX 3 CONTROLLER

FIG.16

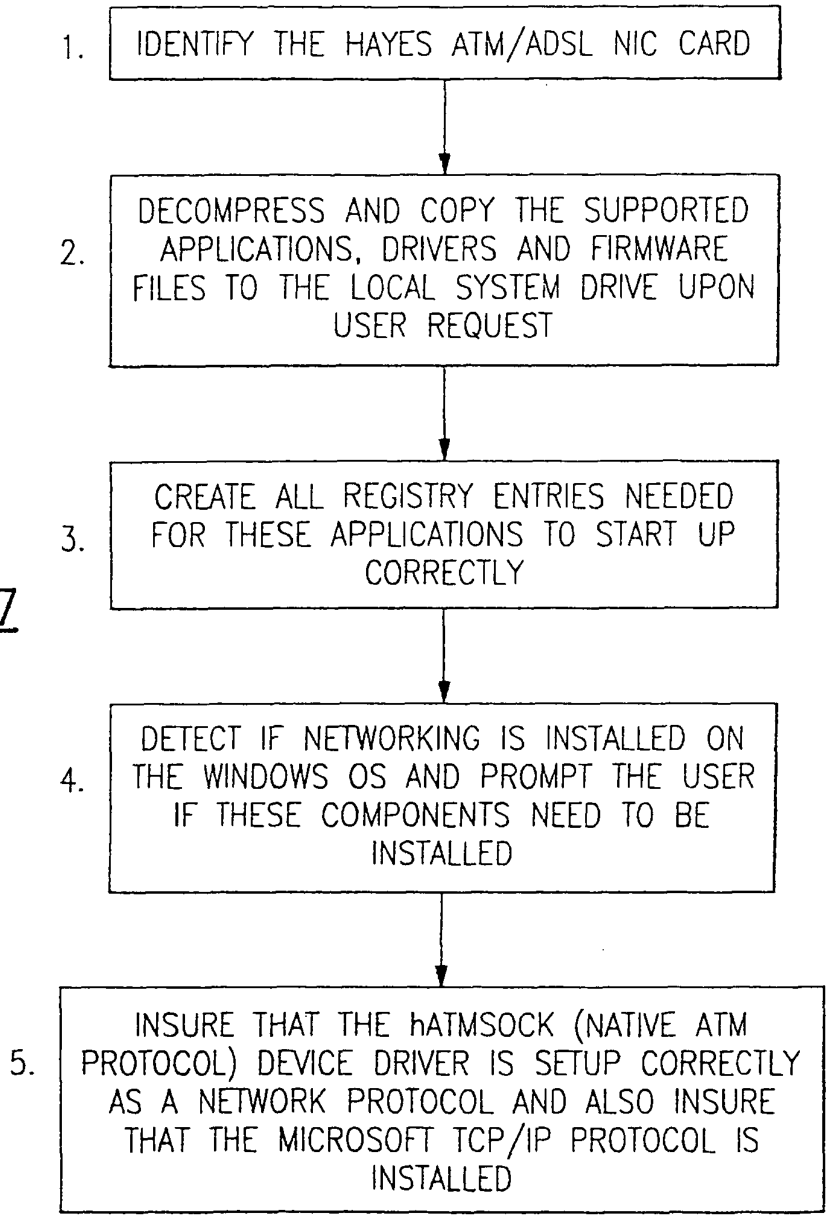

1.
IDENTIFY THE HAYES ATM/ADSL NIC CARD
2.
DECOMPRESS AND COPY THE SUPPORTED APPLICATIONS, DRIVERS AND FIRMWARE FILES TO THE LOCAL SYSTEM DRIVE UPON USER REQUEST
3.
CREATE ALL REGISTRY ENTRIES NEEDED FOR THESE APPLICATIONS TO START UP CORRECTLY
4.
DETECT IF NETWORKING IS INSTALLED ON THE WINDOWS OS AND PROMPT THE USER IF THESE COMPONENTS NEED TO BE INSTALLED
5.
INSURE THAT THE hATMSOCK (NATIVE ATM PROTOCOL) DEVICE DRIVER IS SETUP CORRECTLY AS A NETWORK PROTOCOL AND ALSO INSURE THAT THE MICROSOFT TCP/IP PROTOCOL IS INSTALLED

FIG.17

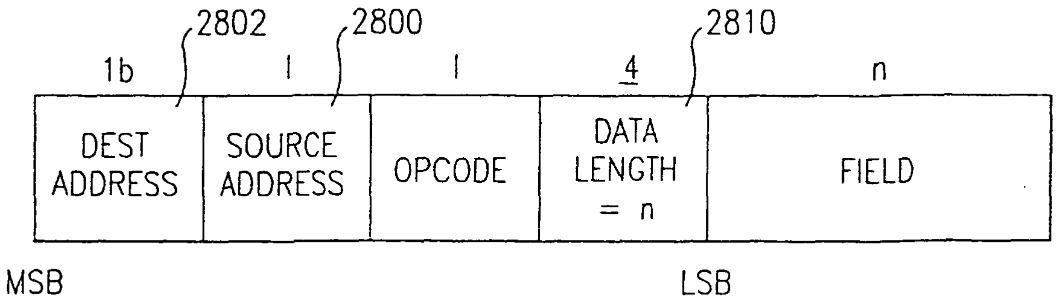
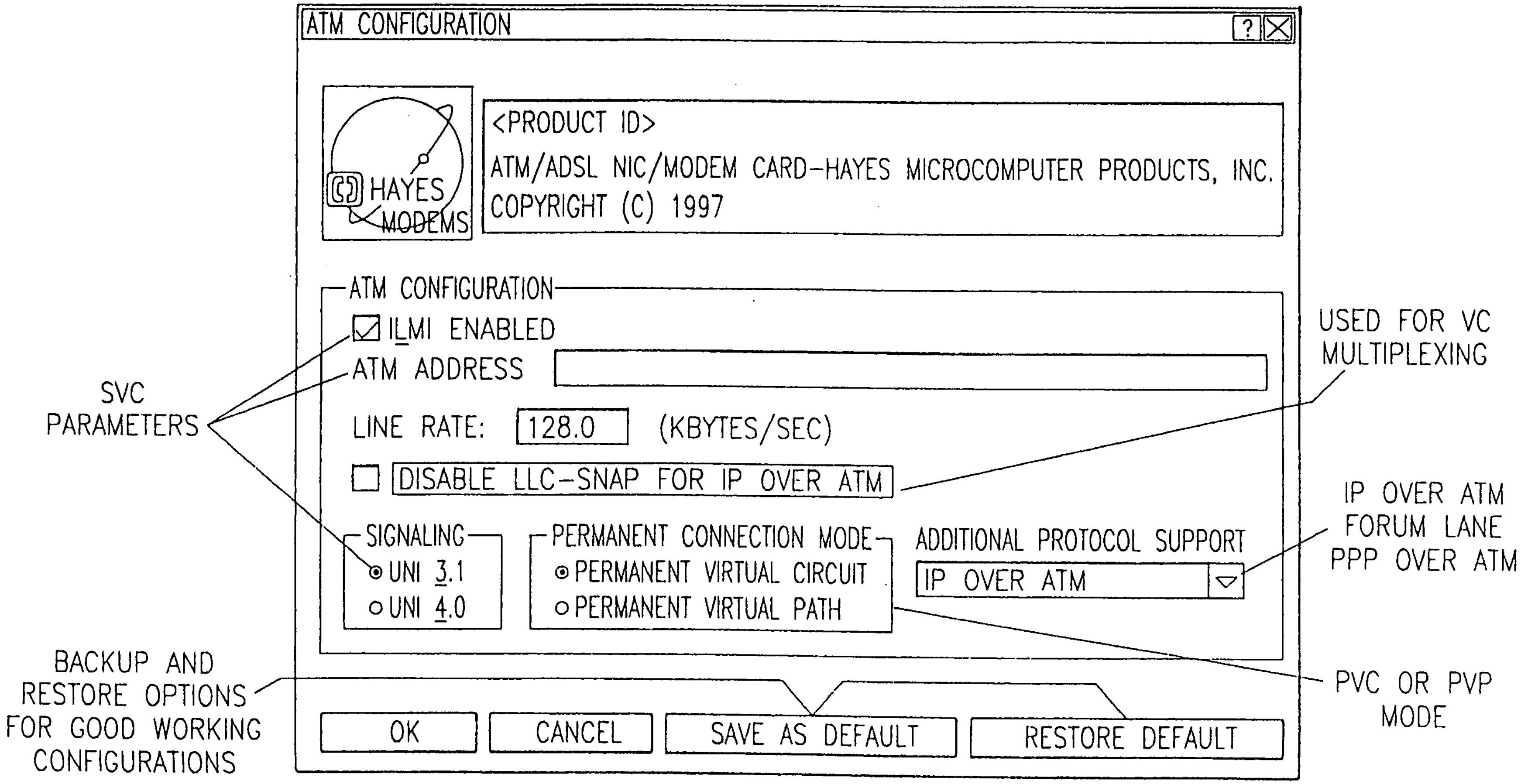

2802
2800
2810
1b
l
l
4
n
DEST ADDRESS
SOURCE ADDRESS
OPCODE
DATA LENGTH = n
FIELD
MSB
LSB

FIG.28



ATM CONFIGURATION

<PRODUCT ID>
ATM/ADSL NIC/MODEM CARD-HAYES MICROCOMPUTER PRODUCTS, INC.
COPYRIGHT (C) 1997

ATM CONFIGURATION

☒ ILMI ENABLED

ATM ADDRESS

LINE RATE: 128.0 (KBYTES/SEC)

□ DISABLE LLC-SNAP FOR IP OVER ATM

SIGNALING
- ● UNI 3.1
- ○ UNI 4.0

PERMANENT CONNECTION MODE
- ● PERMANENT VIRTUAL CIRCUIT
- ○ PERMANENT VIRTUAL PATH

ADDITIONAL PROTOCOL SUPPORT: IP OVER ATM

FIG.18

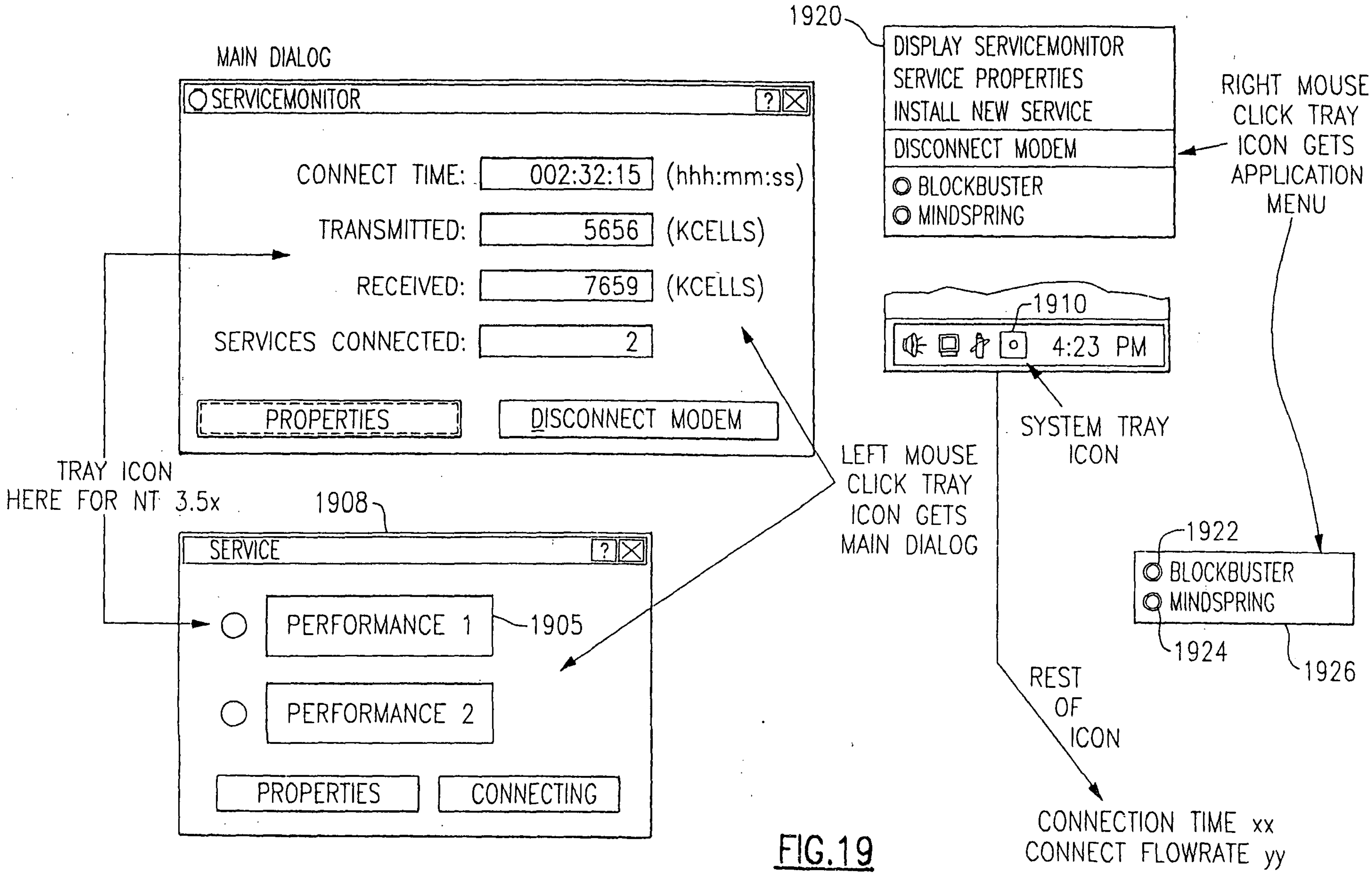

MAIN DIALOG
○ SERVICEMONITOR
? ☒
CONNECT TIME: 002:32:15 (hhh:mm:ss)
TRANSMITTED: 5656 (KCELLS)
RECEIVED: 7659 (KCELLS)
SERVICES CONNECTED: 2
PROPERTIES
DISCONNECT MODEM
TRAY ICON HERE FOR NT 3.5x
1908
SERVICE
○ PERFORMANCE 1
1905
○ PERFORMANCE 2
PROPERTIES
CONNECTING
LEFT MOUSE CLICK TRAY ICON GETS MAIN DIALOG
1920
DISPLAY SERVICEMONITOR
SERVICE PROPERTIES
INSTALL NEW SERVICE
DISCONNECT MODEM
○ BLOCKBUSTER
○ MINDSPRING
RIGHT MOUSE CLICK TRAY ICON GETS APPLICATION MENU
1910
4:23 PM
SYSTEM TRAY ICON
REST OF ICON
CONNECTION TIME xx
CONNECT FLOWRATE yy
1922
○ BLOCKBUSTER
○ MINDSPRING
1924
1926

FIG.19

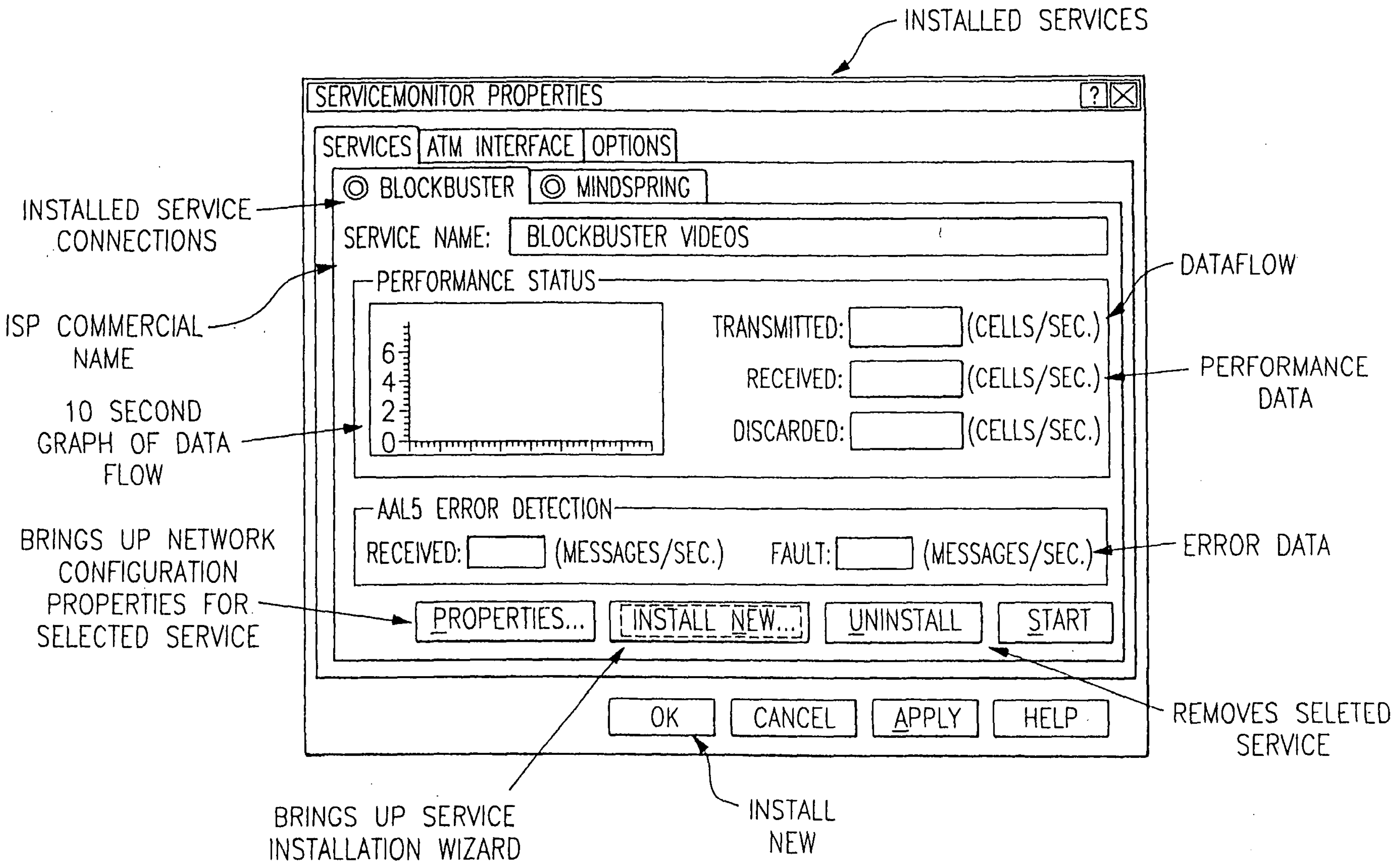
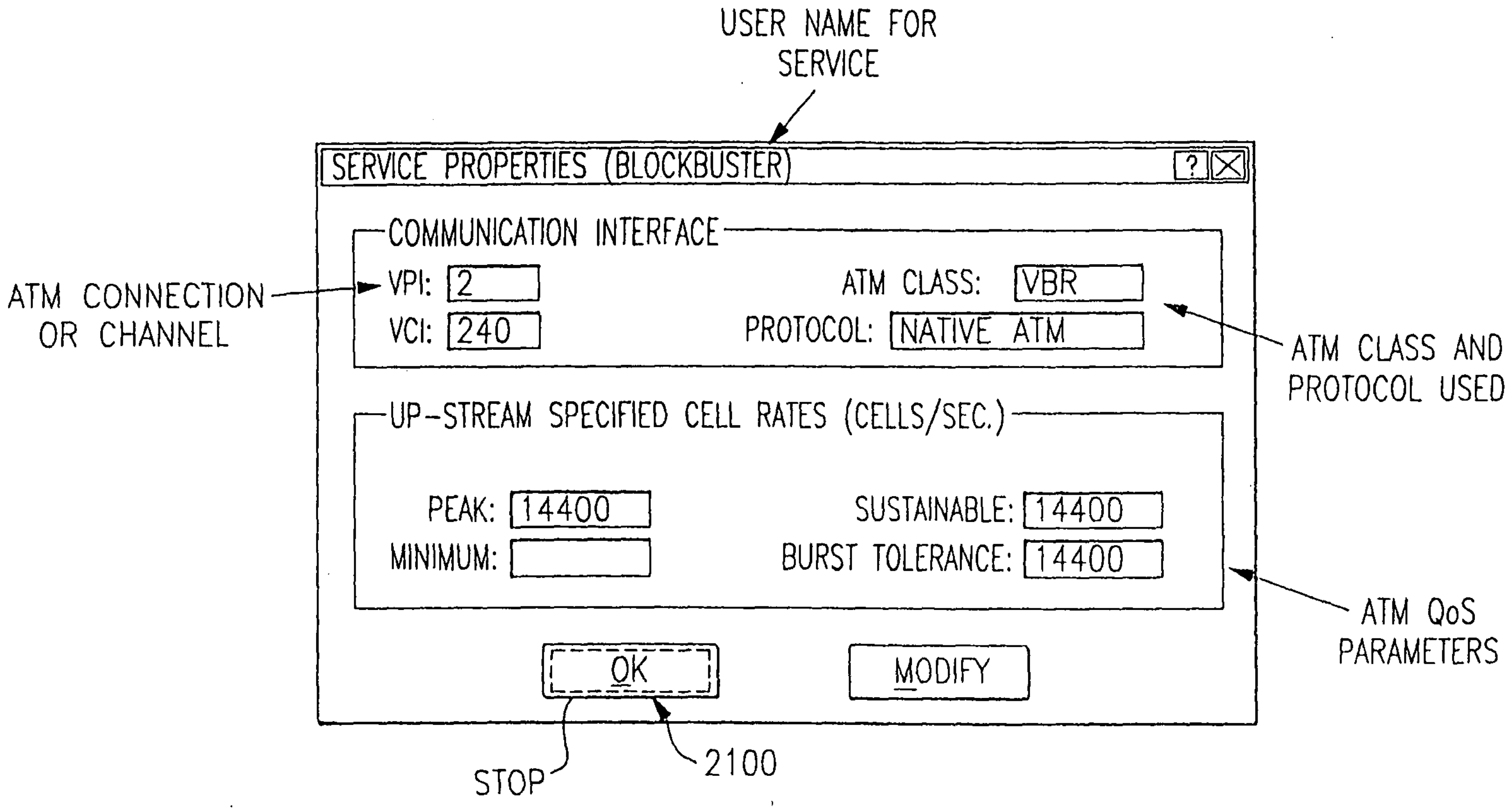

INSTALLED SERVICES
SERVICEMONITOR PROPERTIES
?
☒
SERVICES
ATM INTERFACE
OPTIONS
◎ BLOCKBUSTER
◎ MINDSPRING
SERVICE NAME:
BLOCKBUSTER VIDEOS
PERFORMANCE STATUS
6
4
2
0
TRANSMITTED:
(CELLS/SEC.)
RECEIVED:
(CELLS/SEC.)
DISCARDED:
(CELLS/SEC.)
AAL5 ERROR DETECTION
RECEIVED:
(MESSAGES/SEC.)
FAULT:
(MESSAGES/SEC.)
PROPERTIES...
INSTALL NEW...
UNINSTALL
START
OK
CANCEL
APPLY
HELP
INSTALLED SERVICE CONNECTIONS
ISP COMMERCIAL NAME
10 SECOND GRAPH OF DATA FLOW
BRINGS UP NETWORK CONFIGURATION PROPERTIES FOR SELECTED SERVICE
DATAFLOW
PERFORMANCE DATA
ERROR DATA
REMOVES SELETED SERVICE
BRINGS UP SERVICE INSTALLATION WIZARD
INSTALL NEW

FIG.20



SERVICE PROPERTIES (BLOCKBUSTER)

COMMUNICATION INTERFACE

VPI: 2

VCI: 240

ATM CLASS: VBR

PROTOCOL: NATIVE ATM

UP-STREAM SPECIFIED CELL RATES (CELLS/SEC.)

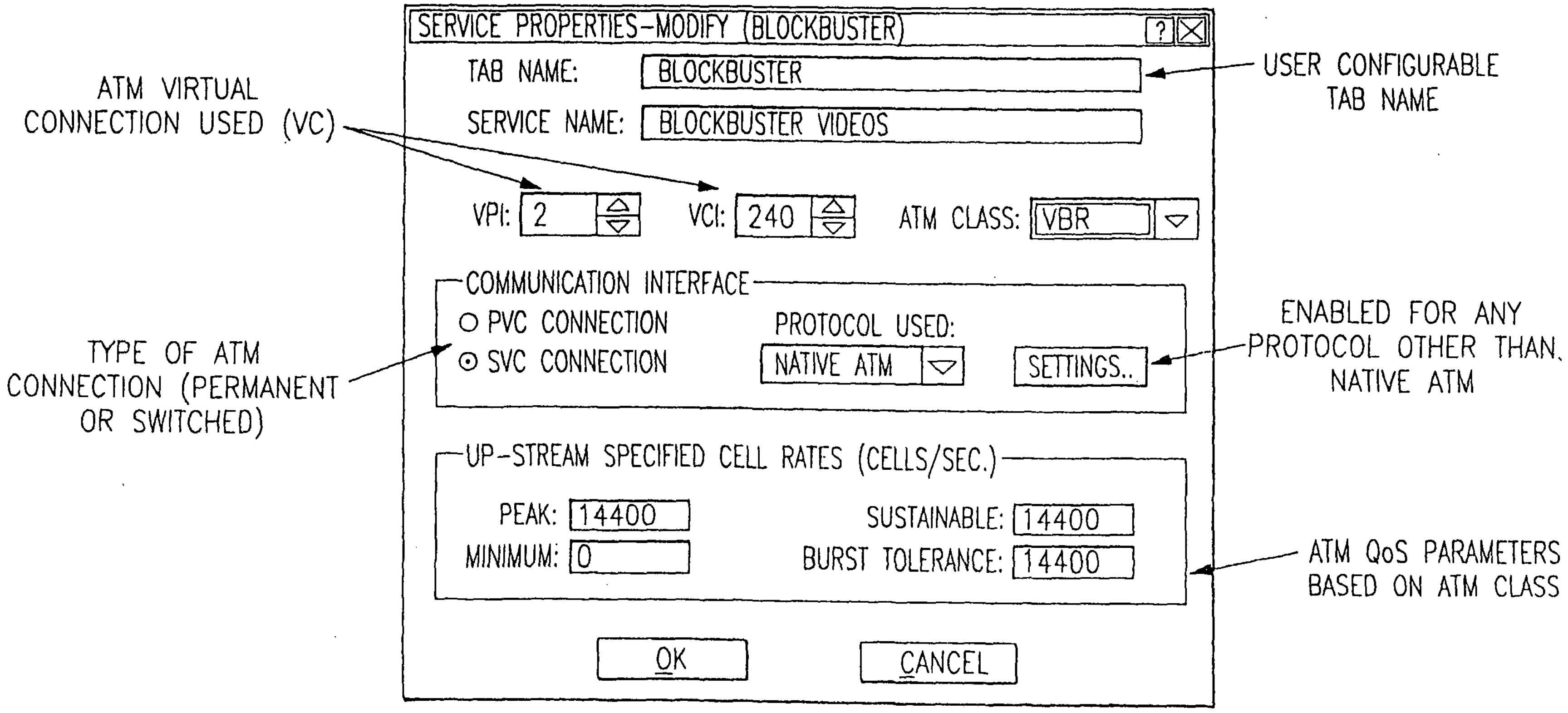
PEAK: 14400

MINIMUM:

SUSTAINABLE: 14400

BURST TOLERANCE: 14400

FIG.21



SERVICE PROPERTIES-MODIFY (BLOCKBUSTER)

TAB NAME: BLOCKBUSTER

SERVICE NAME: BLOCKBUSTER VIDEOS

VPI: 2 VCI: 240 ATM CLASS: VBR

COMMUNICATION INTERFACE

○ PVC CONNECTION

⊙ SVC CONNECTION

PROTOCOL USED: NATIVE ATM

UP-STREAM SPECIFIED CELL RATES (CELLS/SEC.)

PEAK: 14400

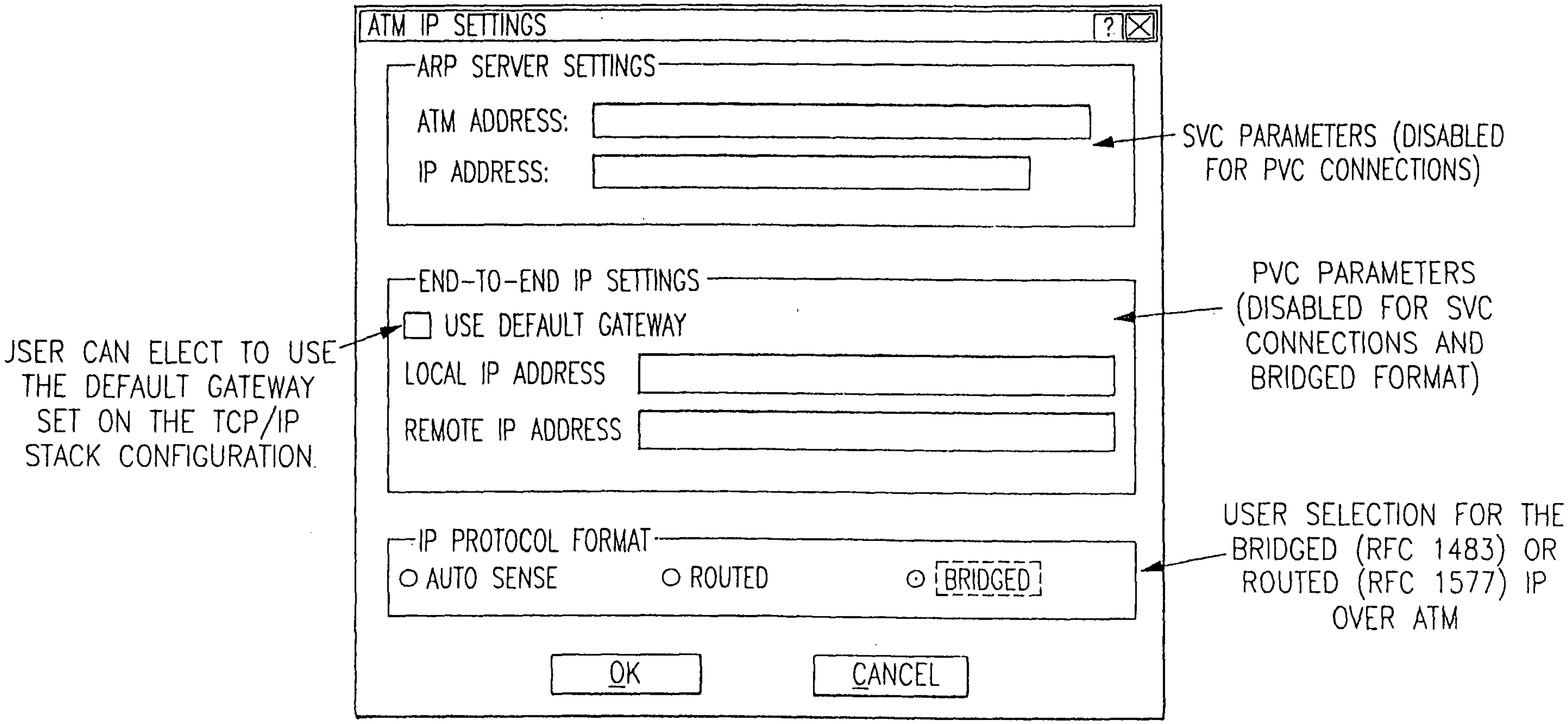
MINIMUM: 0

SUSTAINABLE: 14400

BURST TOLERANCE: 14400

?
☒
SETTINGS..
OK
CANCEL
USER CONFIGURABLE TAB NAME
ATM VIRTUAL CONNECTION USED (VC)
TYPE OF ATM CONNECTION (PERMANENT OR SWITCHED)
ENABLED FOR ANY PROTOCOL OTHER THAN NATIVE ATM
ATM QoS PARAMETERS BASED ON ATM CLASS

FIG.22



□ USE DEFAULT GATEWAY

○ AUTO SENSE ○ ROUTED ⊙ BRIDGED

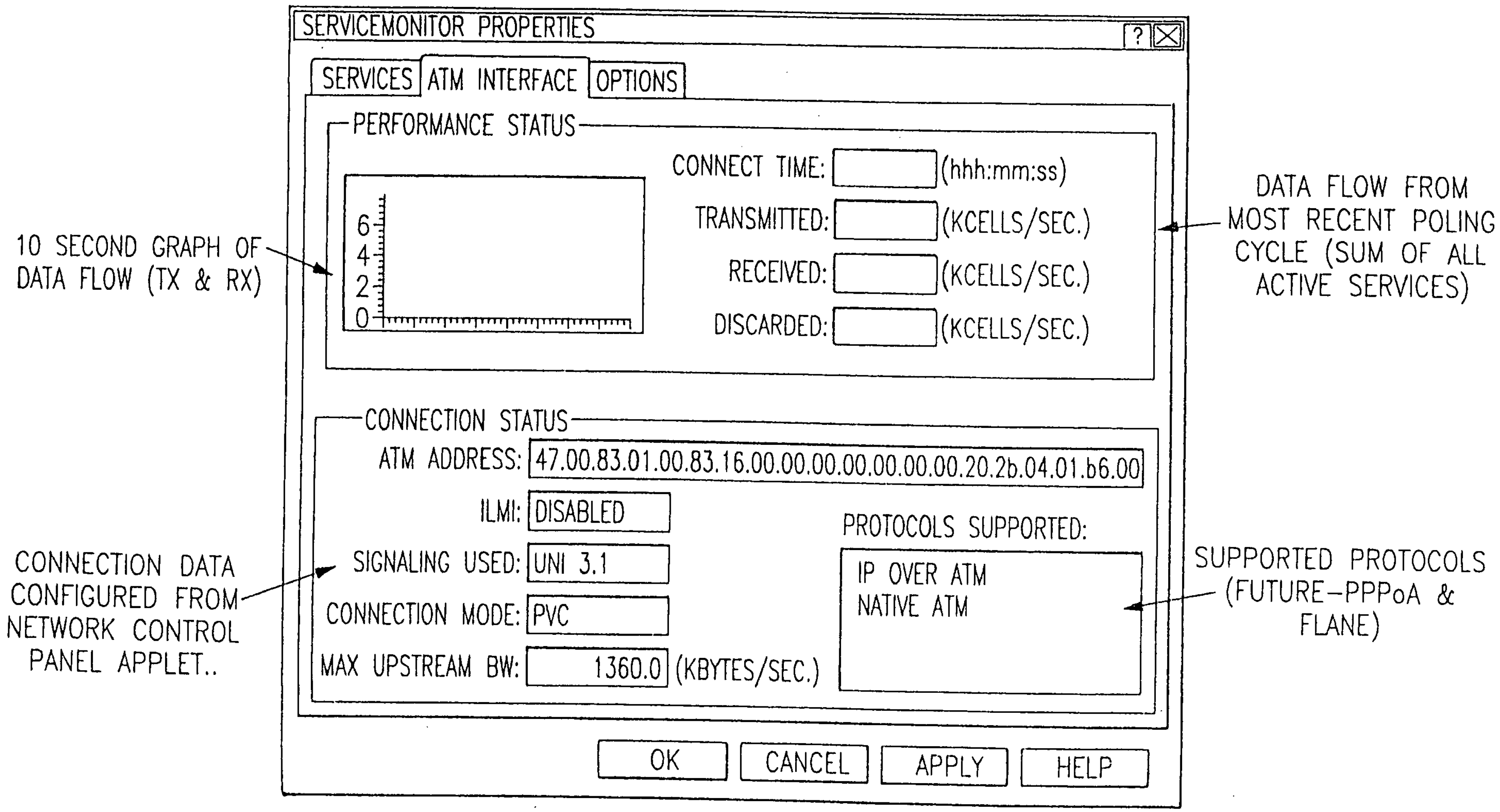
SVC PARAMETERS (DISABLED FOR PVC CONNECTIONS)

PVC PARAMETERS (DISABLED FOR SVC CONNECTIONS AND BRIDGED FORMAT)

JSER CAN ELECT TO USE THE DEFAULT GATEWAY SET ON THE TCP/IP STACK CONFIGURATION.

USER SELECTION FOR THE BRIDGED (RFC 1483) OR ROUTED (RFC 1577) IP OVER ATM

FIG.23



SERVICEMONITOR PROPERTIES

PERFORMANCE STATUS

CONNECT TIME: (hhh:mm:ss)

TRANSMITTED: (KCELLS/SEC.)

RECEIVED: (KCELLS/SEC.)

DISCARDED: (KCELLS/SEC.)

CONNECTION STATUS

ATM ADDRESS: 47.00.83.01.00.83.16.00.00.00.00.00.00.00.20.2b.04.01.b6.00

ILMI: DISABLED

SIGNALING USED: UNI 3.1

CONNECTION MODE: PVC

MAX UPSTREAM BW: 1360.0 (KBYTES/SEC.)

PROTOCOLS SUPPORTED:

IP OVER ATM
NATIVE ATM

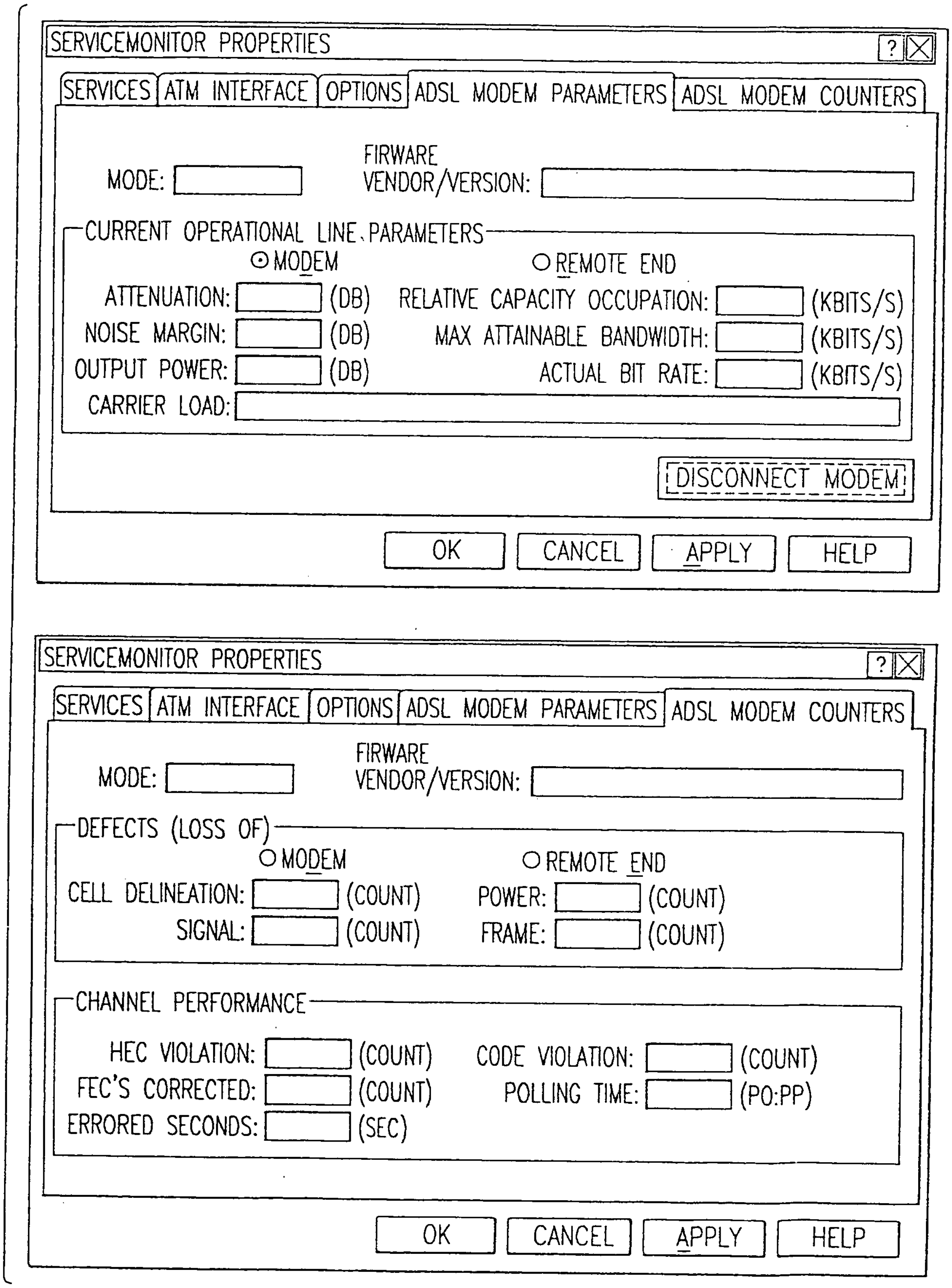
10 SECOND GRAPH OF DATA FLOW (TX & RX)

DATA FLOW FROM MOST RECENT POLING CYCLE (SUM OF ALL ACTIVE SERVICES)

CONNECTION DATA CONFIGURED FROM NETWORK CONTROL PANEL APPLET..

SUPPORTED PROTOCOLS (FUTURE–PPPoA & FLANE)

FIG.24



SERVICEMONITOR PROPERTIES ? ☒

SERVICES | ATM INTERFACE | OPTIONS | ADSL MODEM PARAMETERS | ADSL MODEM COUNTERS

MODE: □ FIRWARE VENDOR/VERSION: □

CURRENT OPERATIONAL LINE PARAMETERS

● MODEM ○ REMOTE END

ATTENUATION: □ (DB) RELATIVE CAPACITY OCCUPATION: □ (KBITS/S)

NOISE MARGIN: □ (DB) MAX ATTAINABLE BANDWIDTH: □ (KBITS/S)

OUTPUT POWER: □ (DB) ACTUAL BIT RATE: □ (KBITS/S)

CARRIER LOAD: □

DISCONNECT MODEM

OK | CANCEL | APPLY | HELP

SERVICEMONITOR PROPERTIES ? ☒

SERVICES | ATM INTERFACE | OPTIONS | ADSL MODEM PARAMETERS | ADSL MODEM COUNTERS

MODE: □ FIRWARE VENDOR/VERSION: □

DEFECTS (LOSS OF)

○ MODEM ○ REMOTE END

CELL DELINEATION: □ (COUNT) POWER: □ (COUNT)

SIGNAL: □ (COUNT) FRAME: □ (COUNT)

CHANNEL PERFORMANCE

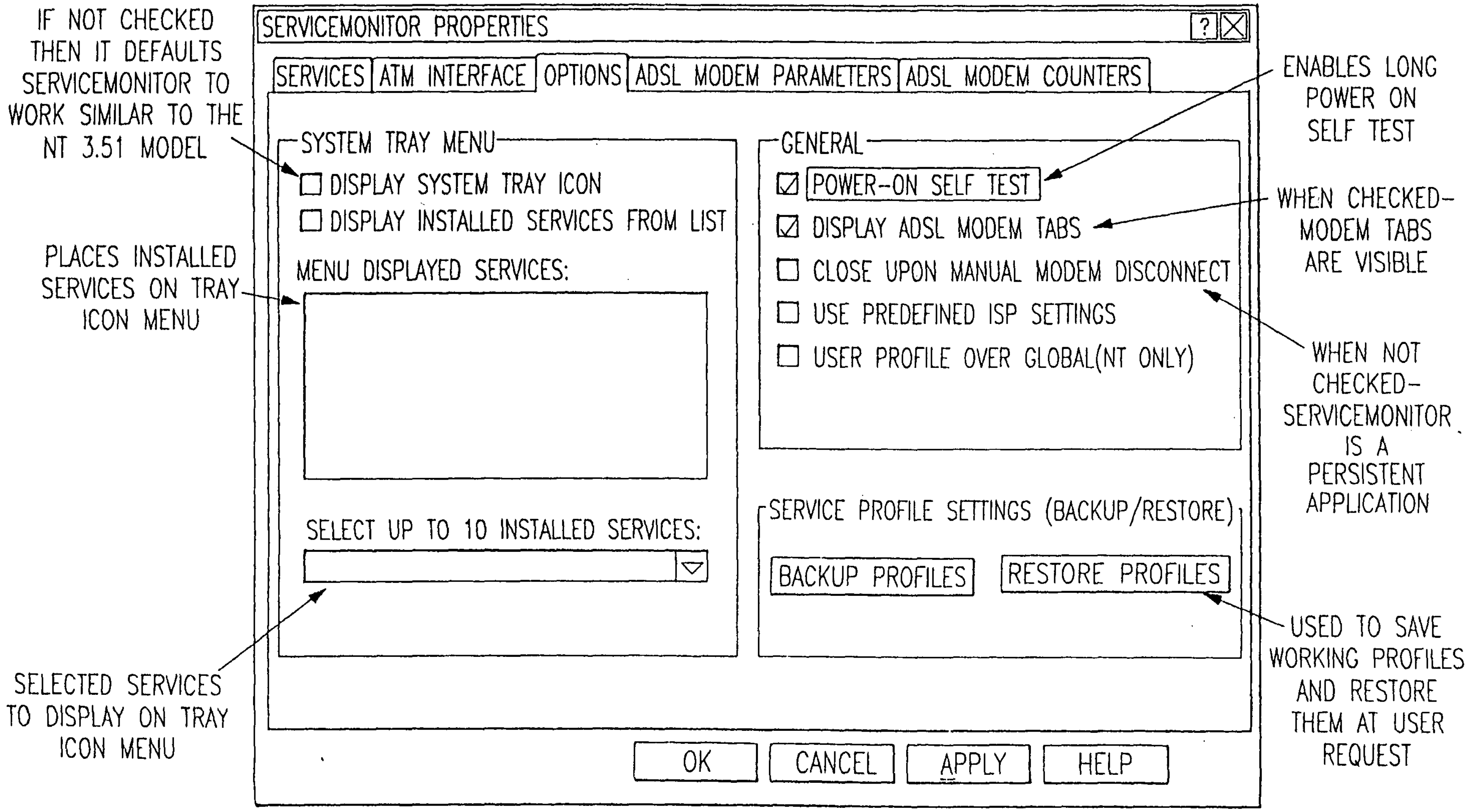
HEC VIOLATION: □ (COUNT) CODE VIOLATION: □ (COUNT)

FEC'S CORRECTED: □ (COUNT) POLLING TIME: □ (PO:PP)

ERRORED SECONDS: □ (SEC)

OK | CANCEL | APPLY | HELP

FIG.25



SYSTEM TRAY MENU

☐ DISPLAY SYSTEM TRAY ICON
☐ DISPLAY INSTALLED SERVICES FROM LIST

MENU DISPLAYED SERVICES:

SELECT UP TO 10 INSTALLED SERVICES:

GENERAL

☑ POWER-ON SELF TEST
☑ DISPLAY ADSL MODEM TABS
☐ CLOSE UPON MANUAL MODEM DISCONNECT
☐ USE PREDEFINED ISP SETTINGS
☐ USER PROFILE OVER GLOBAL(NT ONLY)

SERVICE PROFILE SETTINGS (BACKUP/RESTORE)

IF NOT CHECKED THEN IT DEFAULTS SERVICEMONITOR TO WORK SIMILAR TO THE NT 3.51 MODEL

PLACES INSTALLED SERVICES ON TRAY ICON MENU

SELECTED SERVICES TO DISPLAY ON TRAY ICON MENU

ENABLES LONG POWER ON SELF TEST

WHEN CHECKED- MODEM TABS ARE VISIBLE

WHEN NOT CHECKED- SERVICEMONITOR IS A PERSISTENT APPLICATION

USED TO SAVE WORKING PROFILES AND RESTORE THEM AT USER REQUEST

FIG.26

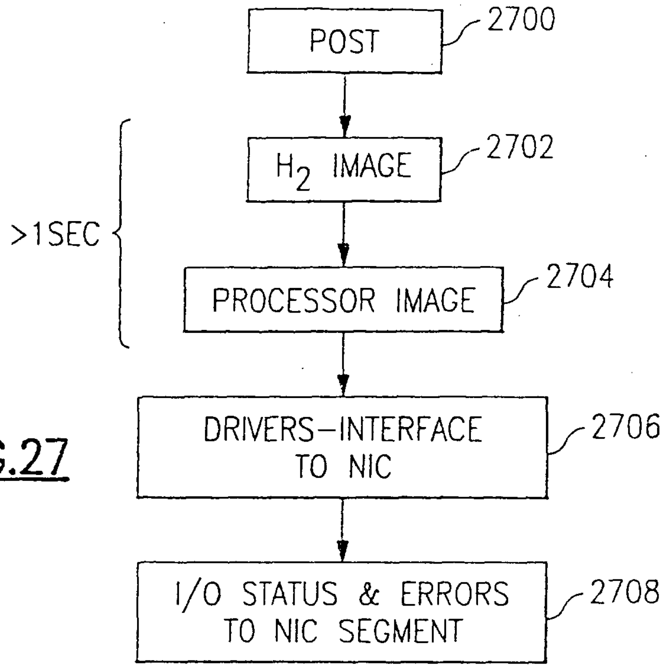

POST
2700
H$_2$ IMAGE
2702
>1SEC
PROCESSOR IMAGE
2704
DRIVERS-INTERFACE TO NIC
2706
I/O STATUS & ERRORS TO NIC SEGMENT
2708

FIG.27

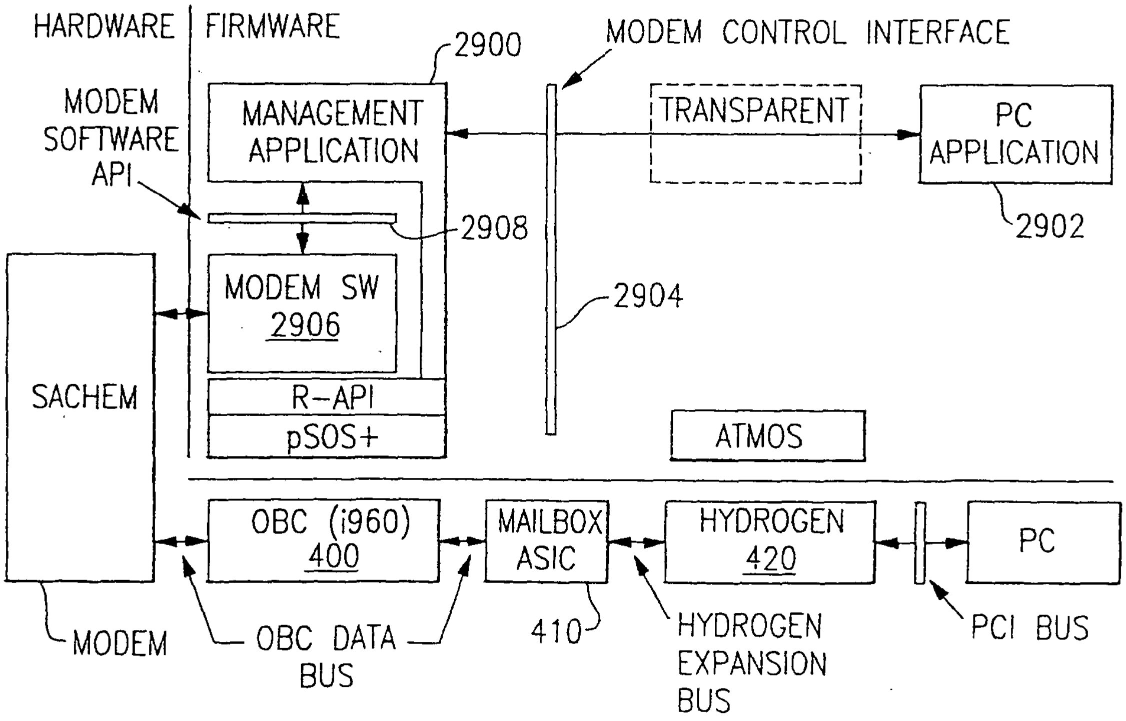

HARDWARE
FIRMWARE
2900
MODEM CONTROL INTERFACE
MODEM SOFTWARE API
MANAGEMENT APPLICATION
TRANSPARENT
PC APPLICATION
2908
2902
MODEM SW
2906
2904
SACHEM
R-API
pSOS+
ATMOS
OBC (i960)
400
MAILBOX ASIC
HYDROGEN
420
PC
MODEM
OBC DATA BUS
410
HYDROGEN EXPANSION BUS
PCI BUS

FIG.29

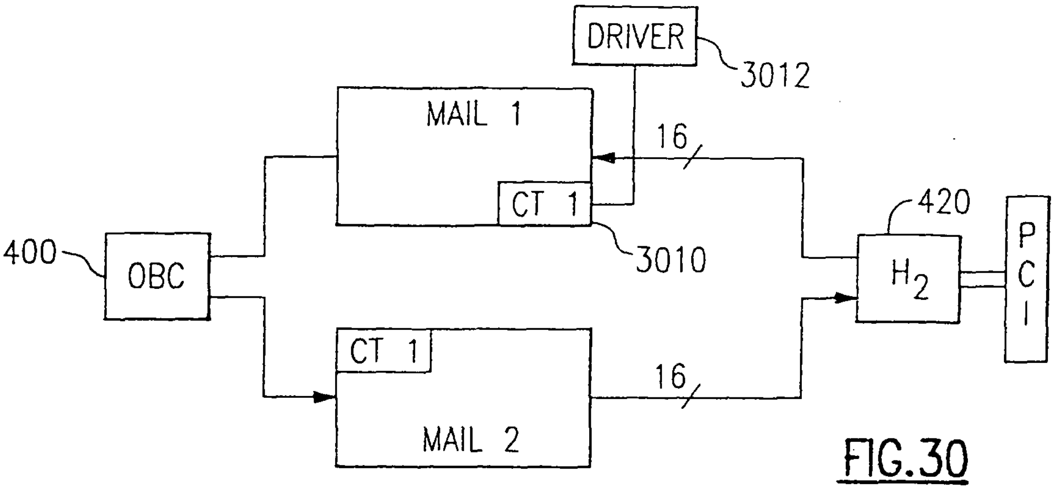
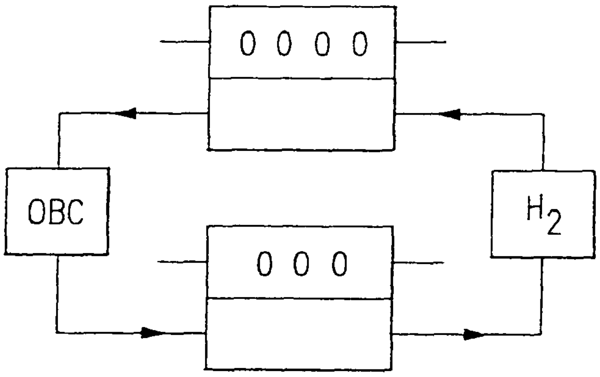


FIG.30

FIG.31



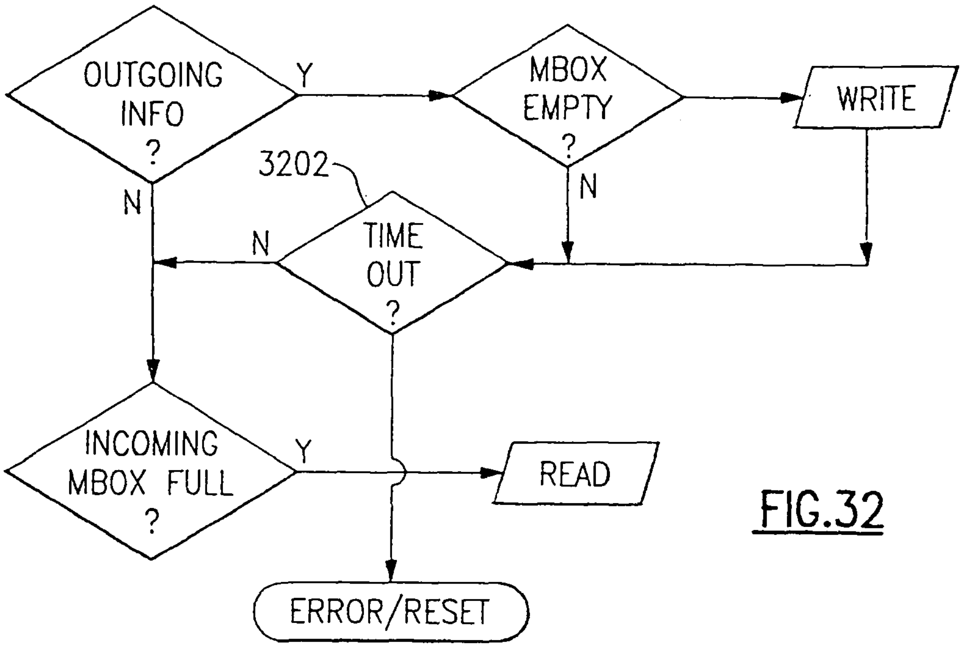


FIG.32

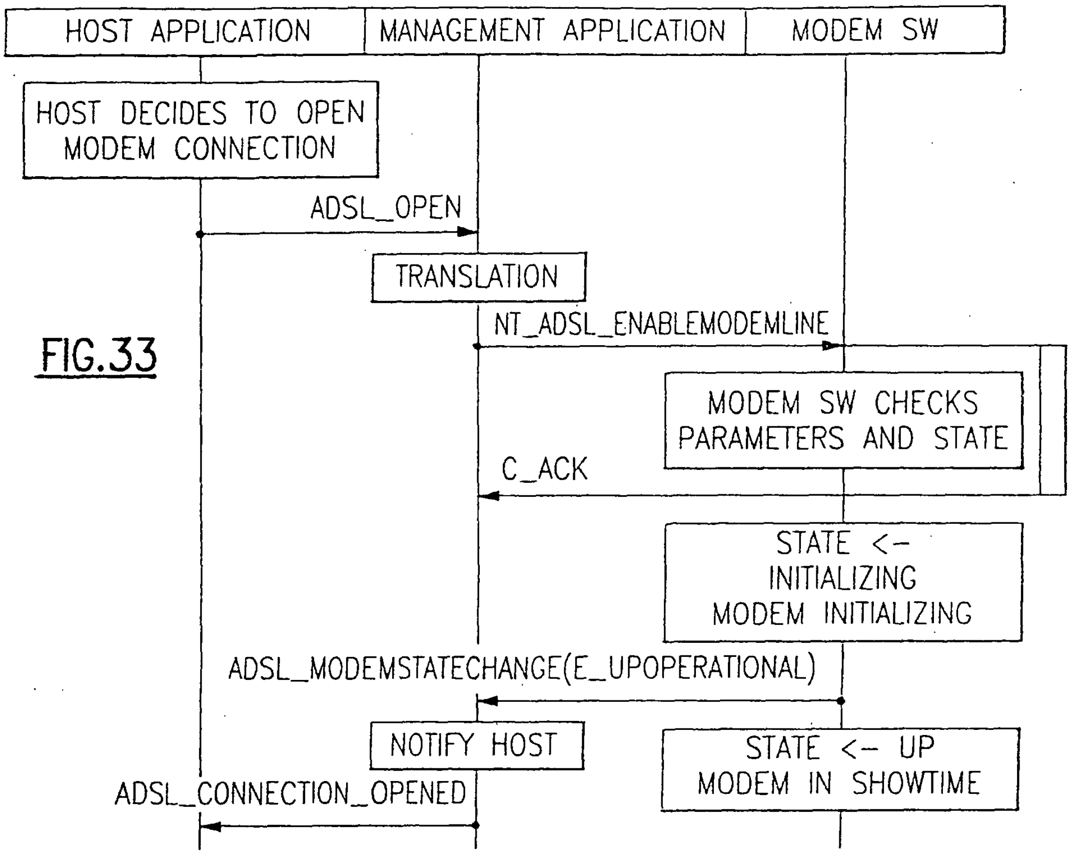

HOST APPLICATION
MANAGEMENT APPLICATION
MODEM SW
HOST DECIDES TO OPEN MODEM CONNECTION
ADSL_OPEN
TRANSLATION
NT_ADSL_ENABLEMODEMLINE
MODEM SW CHECKS PARAMETERS AND STATE
C_ACK
STATE <- INITIALIZING MODEM INITIALIZING
ADSL_MODEMSTATECHANGE(E_UPOPERATIONAL)
NOTIFY HOST
STATE <- UP MODEM IN SHOWTIME
ADSL_CONNECTION_OPENED

FIG.33

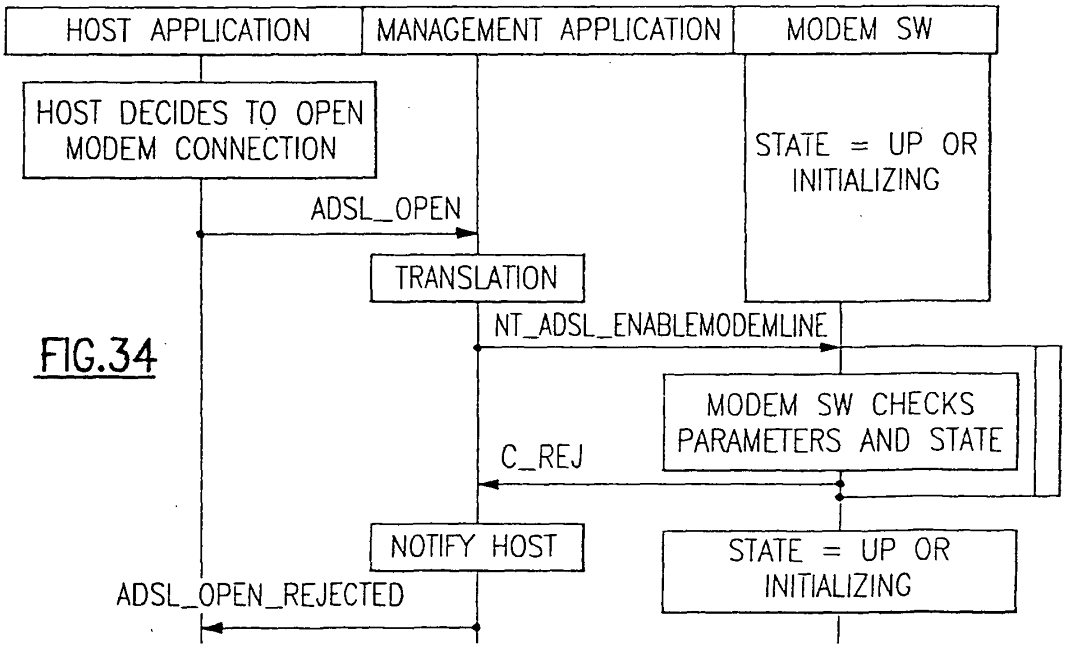

HOST APPLICATION
MANAGEMENT APPLICATION
MODEM SW
HOST DECIDES TO OPEN MODEM CONNECTION
STATE = UP OR INITIALIZING
ADSL_OPEN
TRANSLATION
NT_ADSL_ENABLEMODEMLINE
MODEM SW CHECKS PARAMETERS AND STATE
C_REJ
NOTIFY HOST
STATE = UP OR INITIALIZING
ADSL_OPEN_REJECTED

FIG.34

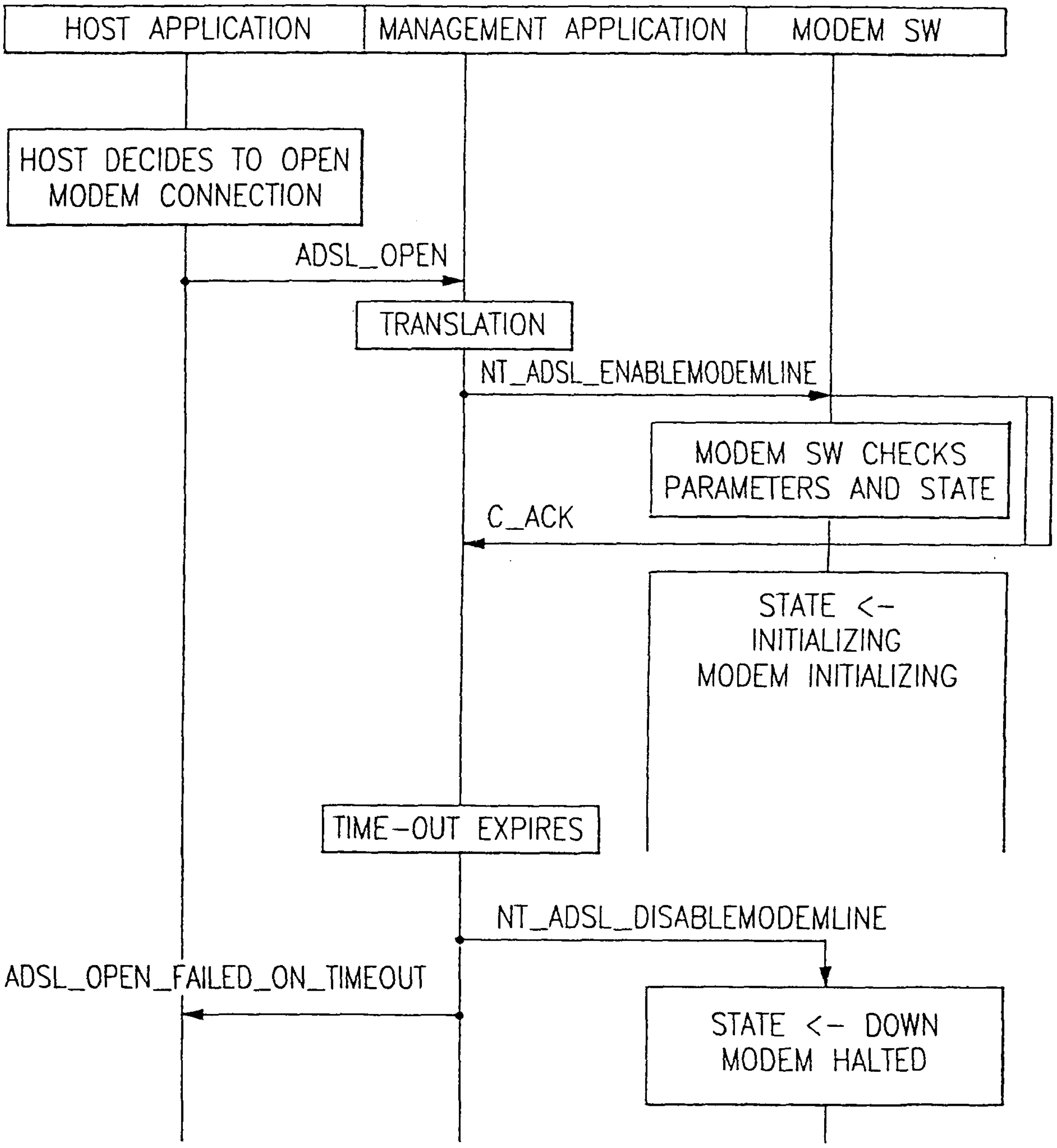

HOST APPLICATION
MANAGEMENT APPLICATION
MODEM SW
HOST DECIDES TO OPEN MODEM CONNECTION
ADSL_OPEN
TRANSLATION
NT_ADSL_ENABLEMODEMLINE
MODEM SW CHECKS PARAMETERS AND STATE
C_ACK
STATE <- INITIALIZING MODEM INITIALIZING
TIME-OUT EXPIRES
NT_ADSL_DISABLEMODEMLINE
ADSL_OPEN_FAILED_ON_TIMEOUT
STATE <- DOWN MODEM HALTED

FIG.35

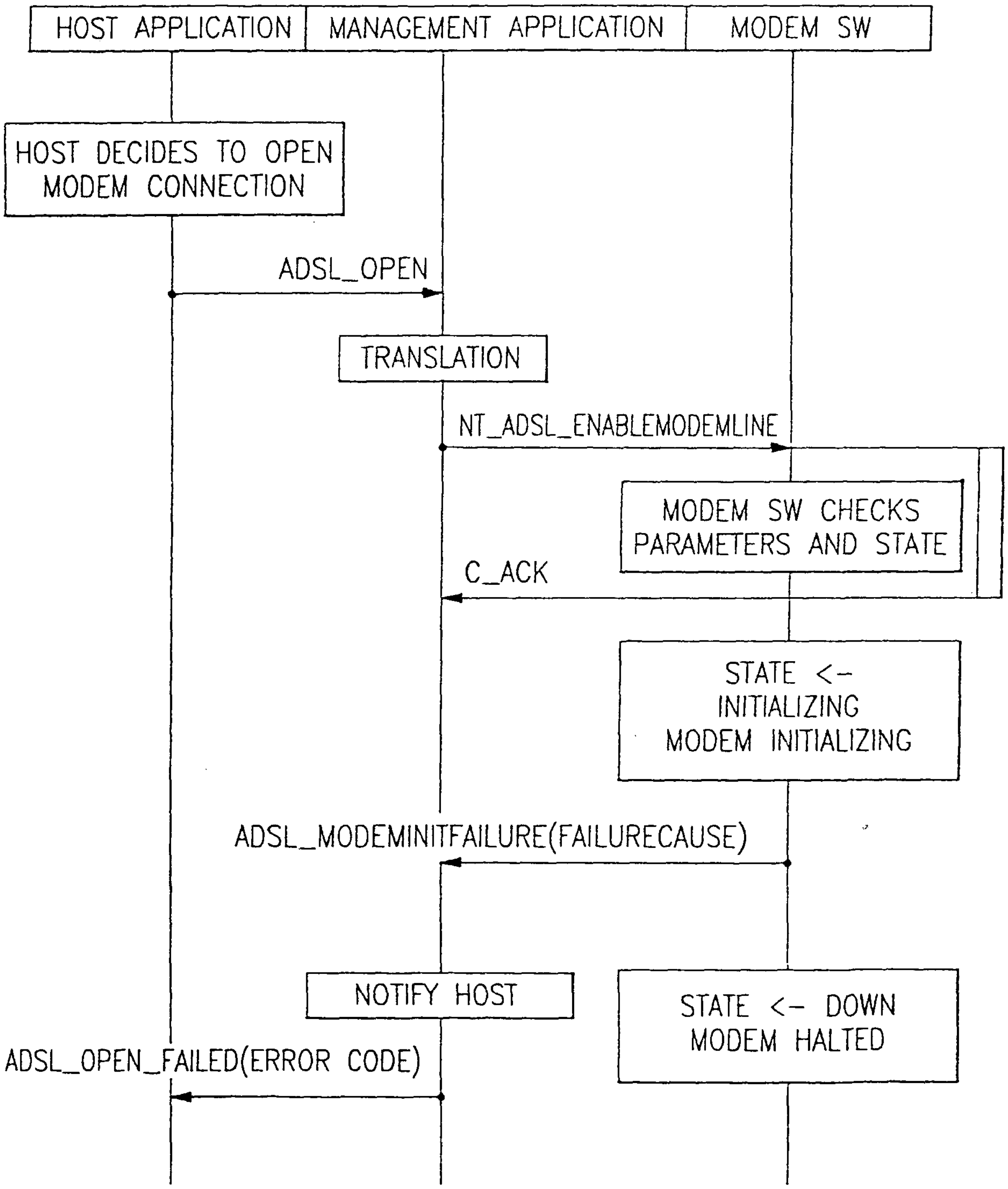

HOST APPLICATION
MANAGEMENT APPLICATION
MODEM SW
HOST DECIDES TO OPEN MODEM CONNECTION
ADSL_OPEN
TRANSLATION
NT_ADSL_ENABLEMODEMLINE
MODEM SW CHECKS PARAMETERS AND STATE
C_ACK
STATE <- INITIALIZING MODEM INITIALIZING
ADSL_MODEMINITFAILURE(FAILURECAUSE)
NOTIFY HOST
STATE <- DOWN MODEM HALTED
ADSL_OPEN_FAILED(ERROR CODE)

FIG.36

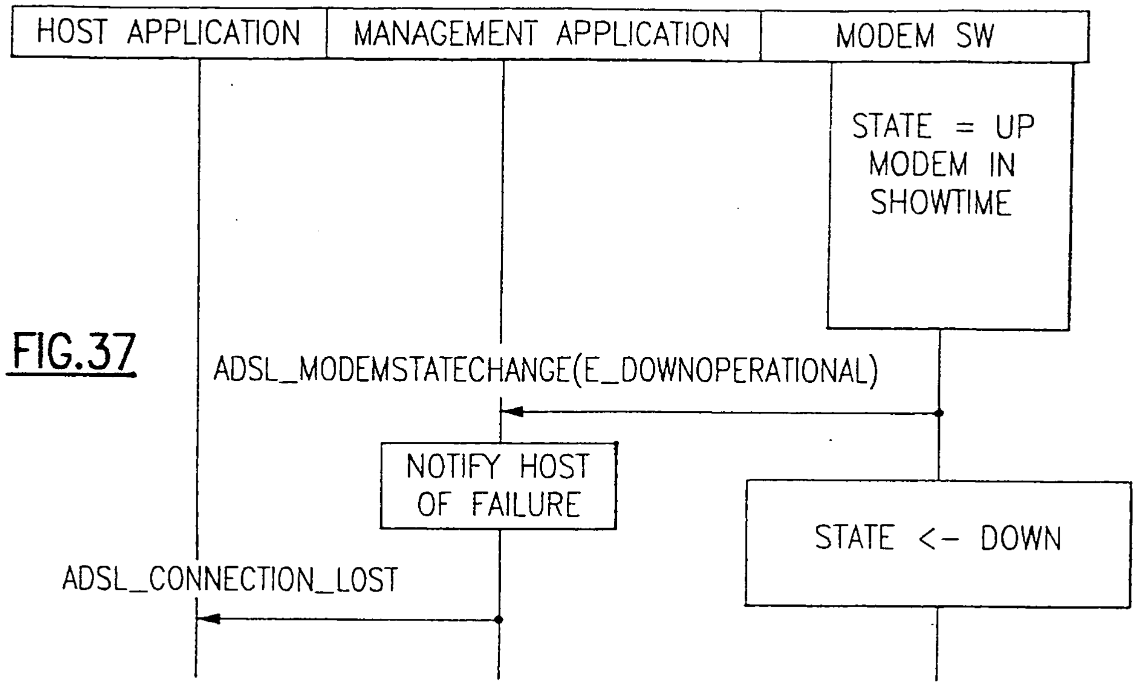

HOST APPLICATION
MANAGEMENT APPLICATION
MODEM SW
STATE = UP
MODEM IN
SHOWTIME
ADSL_MODEMSTATECHANGE(E_DOWNOPERATIONAL)
NOTIFY HOST
OF FAILURE
STATE <- DOWN
ADSL_CONNECTION_LOST

FIG.37

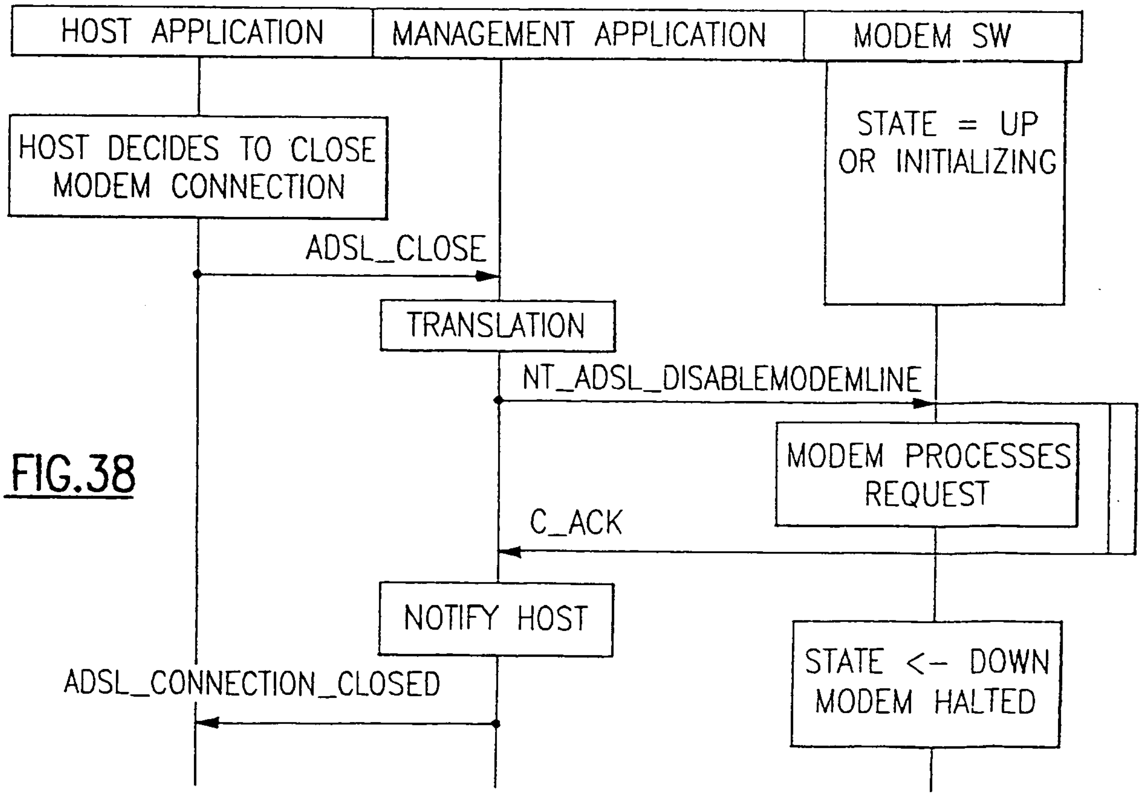

HOST APPLICATION
MANAGEMENT APPLICATION
MODEM SW
HOST DECIDES TO CLOSE
MODEM CONNECTION
STATE = UP
OR INITIALIZING
ADSL_CLOSE
TRANSLATION
NT_ADSL_DISABLEMODEMLINE
MODEM PROCESSES
REQUEST
C_ACK
NOTIFY HOST
STATE <- DOWN
MODEM HALTED
ADSL_CONNECTION_CLOSED

FIG.38

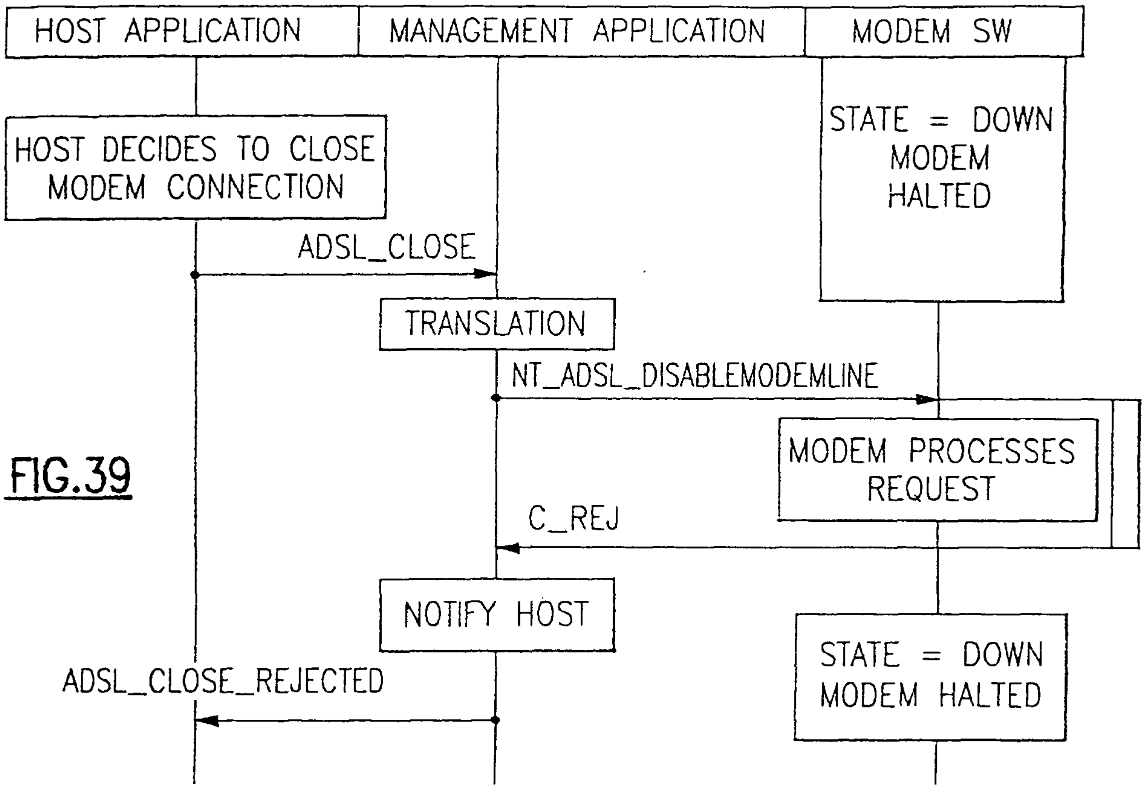

HOST APPLICATION
MANAGEMENT APPLICATION
MODEM SW
HOST DECIDES TO CLOSE MODEM CONNECTION
STATE = DOWN MODEM HALTED
ADSL_CLOSE
TRANSLATION
NT_ADSL_DISABLEMODEMLINE
MODEM PROCESSES REQUEST
C_REJ
NOTIFY HOST
STATE = DOWN MODEM HALTED
ADSL_CLOSE_REJECTED

FIG.39

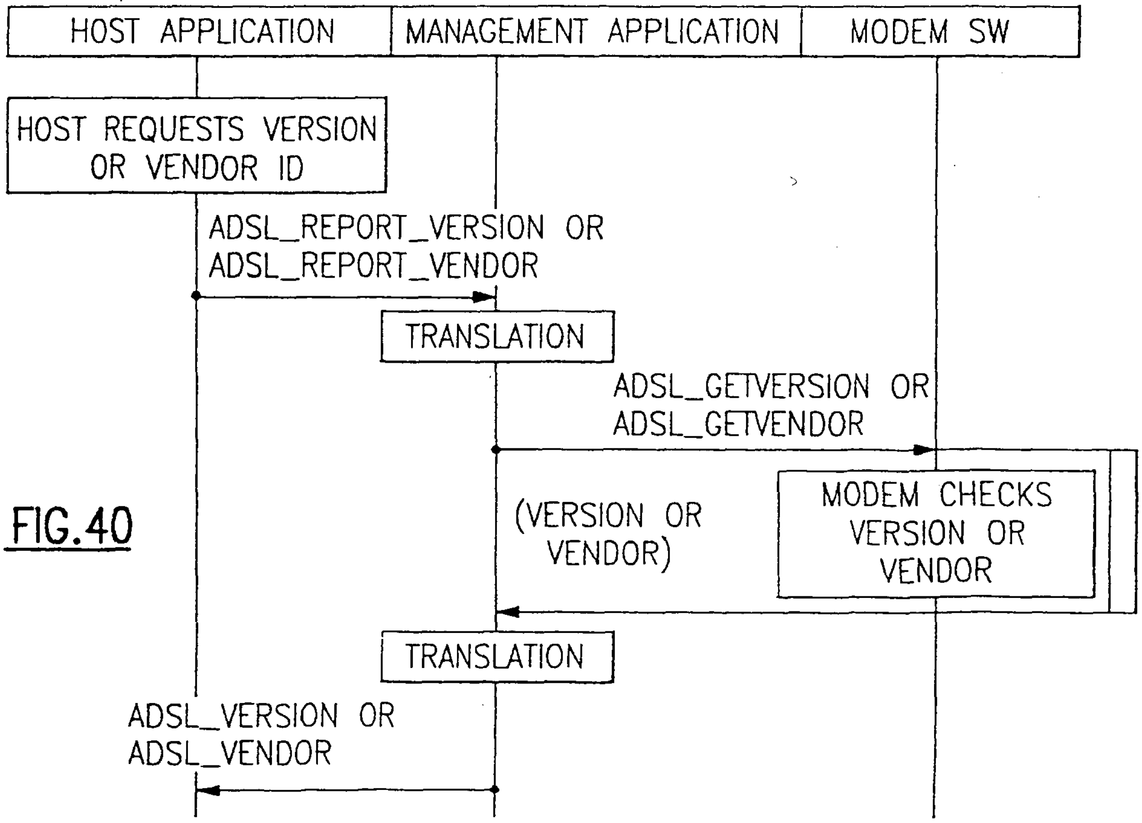

HOST APPLICATION
MANAGEMENT APPLICATION
MODEM SW
HOST REQUESTS VERSION OR VENDOR ID
ADSL_REPORT_VERSION OR ADSL_REPORT_VENDOR
TRANSLATION
ADSL_GETVERSION OR ADSL_GETVENDOR
MODEM CHECKS VERSION OR VENDOR
(VERSION OR VENDOR)
TRANSLATION
ADSL_VERSION OR ADSL_VENDOR

FIG.40

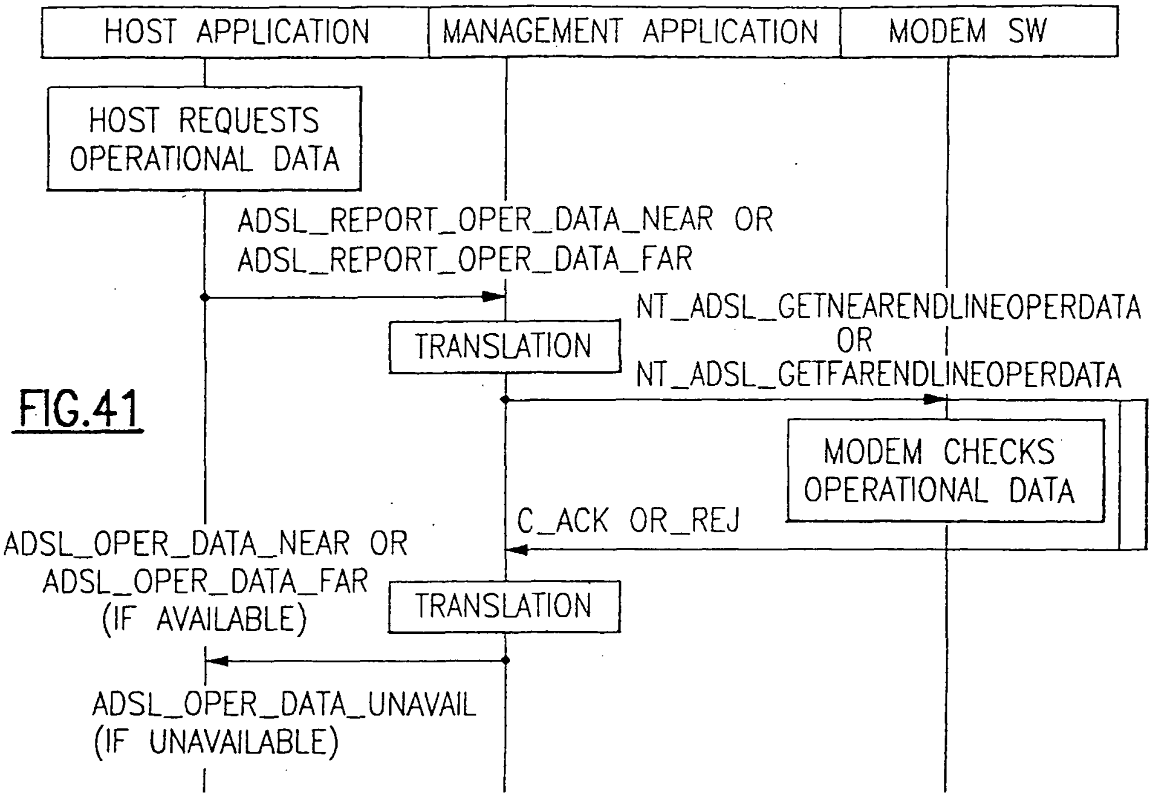

HOST APPLICATION
MANAGEMENT APPLICATION
MODEM SW
HOST REQUESTS OPERATIONAL DATA
ADSL_REPORT_OPER_DATA_NEAR OR ADSL_REPORT_OPER_DATA_FAR
TRANSLATION
NT_ADSL_GETNEARENDLINEOPERDATA OR NT_ADSL_GETFARENDLINEOPERDATA
MODEM CHECKS OPERATIONAL DATA
C_ACK OR_REJ
ADSL_OPER_DATA_NEAR OR ADSL_OPER_DATA_FAR (IF AVAILABLE)
TRANSLATION
ADSL_OPER_DATA_UNAVAIL (IF UNAVAILABLE)

FIG.41

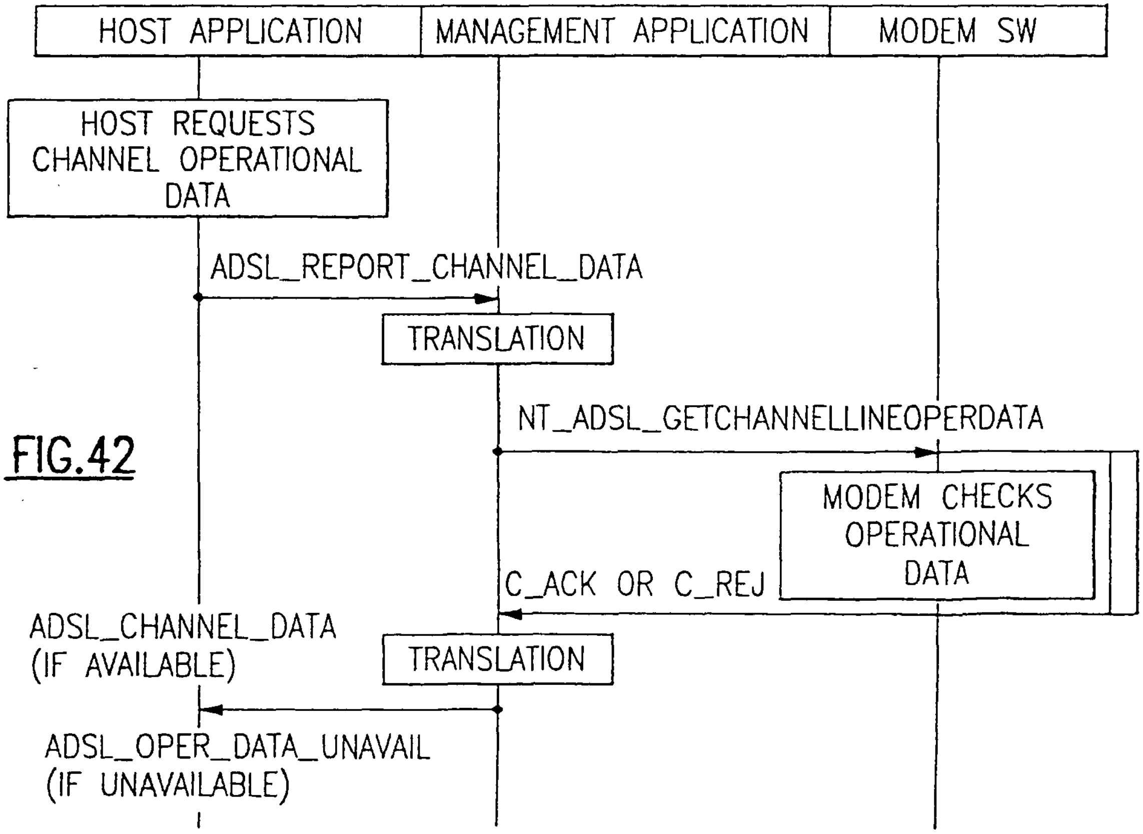

HOST APPLICATION
MANAGEMENT APPLICATION
MODEM SW
HOST REQUESTS CHANNEL OPERATIONAL DATA
ADSL_REPORT_CHANNEL_DATA
TRANSLATION
NT_ADSL_GETCHANNELLINEOPERDATA
MODEM CHECKS OPERATIONAL DATA
C_ACK OR C_REJ
ADSL_CHANNEL_DATA (IF AVAILABLE)
TRANSLATION
ADSL_OPER_DATA_UNAVAIL (IF UNAVAILABLE)

FIG.42

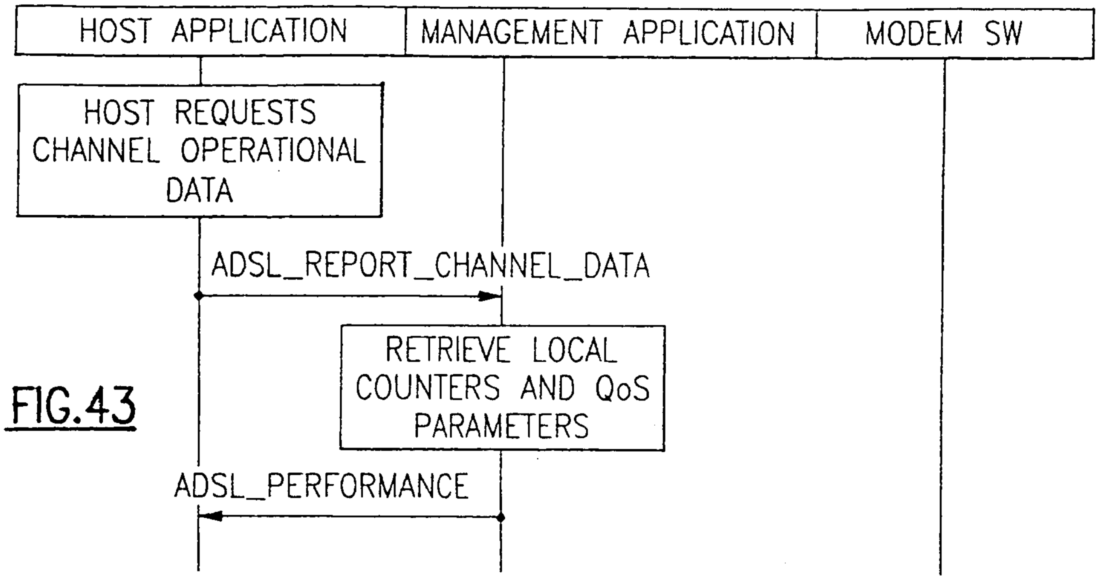

HOST APPLICATION
MANAGEMENT APPLICATION
MODEM SW
HOST REQUESTS CHANNEL OPERATIONAL DATA
ADSL_REPORT_CHANNEL_DATA
RETRIEVE LOCAL COUNTERS AND QoS PARAMETERS
ADSL_PERFORMANCE

FIG.43

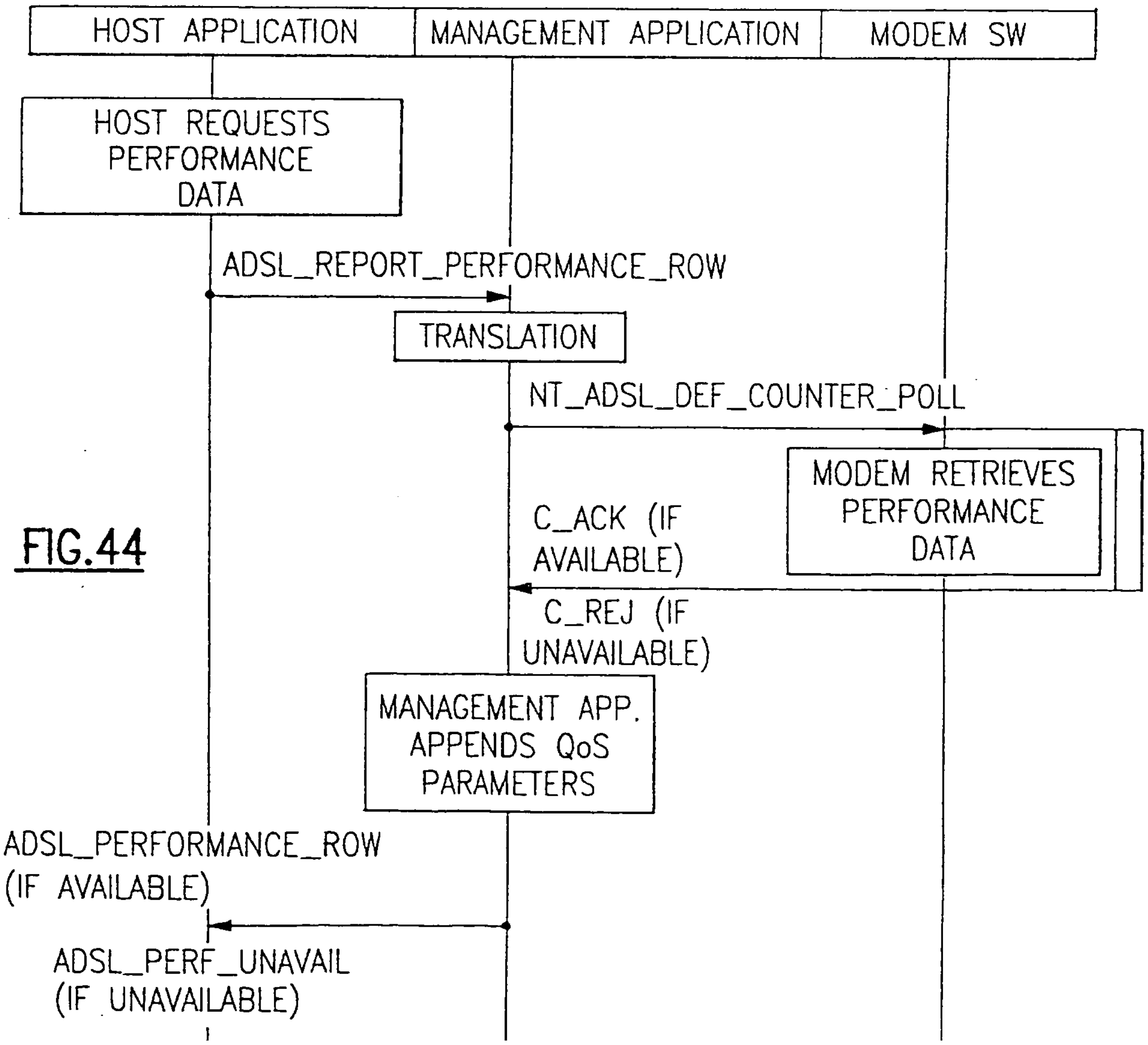

HOST APPLICATION
MANAGEMENT APPLICATION
MODEM SW
HOST REQUESTS PERFORMANCE DATA
ADSL_REPORT_PERFORMANCE_ROW
TRANSLATION
NT_ADSL_DEF_COUNTER_POLL
MODEM RETRIEVES PERFORMANCE DATA
C_ACK (IF AVAILABLE)
C_REJ (IF UNAVAILABLE)
MANAGEMENT APP. APPENDS QoS PARAMETERS
ADSL_PERFORMANCE_ROW (IF AVAILABLE)
ADSL_PERF_UNAVAIL (IF UNAVAILABLE)

FIG.44

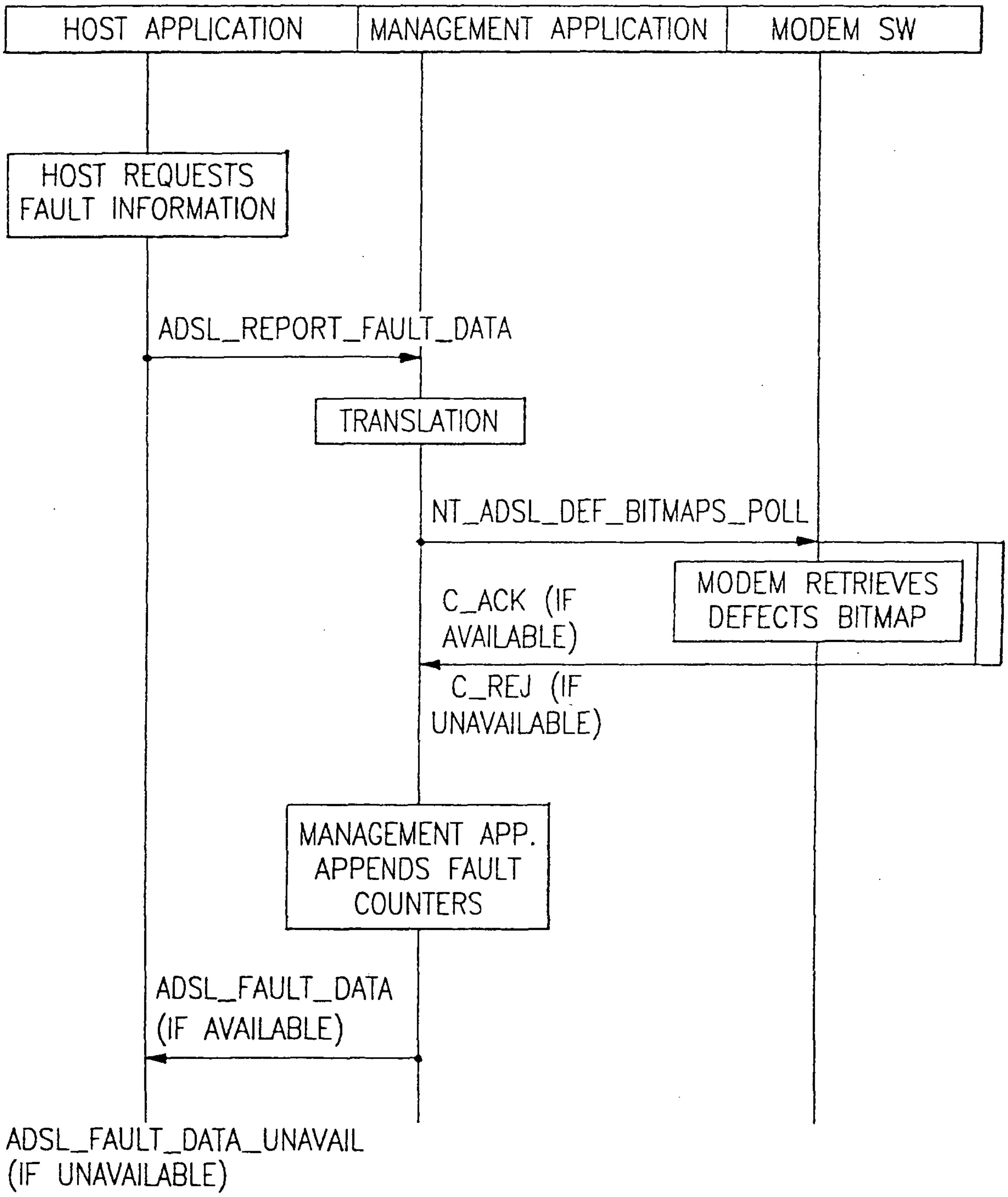

HOST APPLICATION
MANAGEMENT APPLICATION
MODEM SW
HOST REQUESTS FAULT INFORMATION
ADSL_REPORT_FAULT_DATA
TRANSLATION
NT_ADSL_DEF_BITMAPS_POLL
MODEM RETRIEVES DEFECTS BITMAP
C_ACK (IF AVAILABLE)
C_REJ (IF UNAVAILABLE)
MANAGEMENT APP. APPENDS FAULT COUNTERS
ADSL_FAULT_DATA (IF AVAILABLE)
ADSL_FAULT_DATA_UNAVAIL (IF UNAVAILABLE)

FIG.45

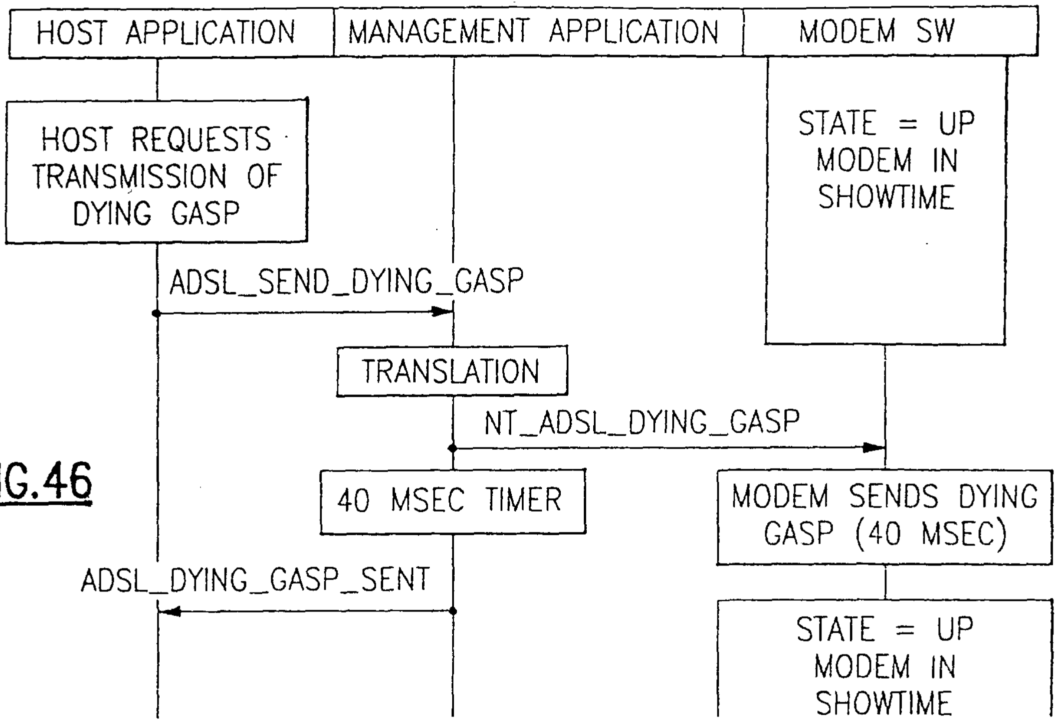

HOST APPLICATION
MANAGEMENT APPLICATION
MODEM SW
HOST REQUESTS TRANSMISSION OF DYING GASP
STATE = UP MODEM IN SHOWTIME
ADSL_SEND_DYING_GASP
TRANSLATION
NT_ADSL_DYING_GASP
40 MSEC TIMER
MODEM SENDS DYING GASP (40 MSEC)
ADSL_DYING_GASP_SENT
STATE = UP MODEM IN SHOWTIME

FIG.46

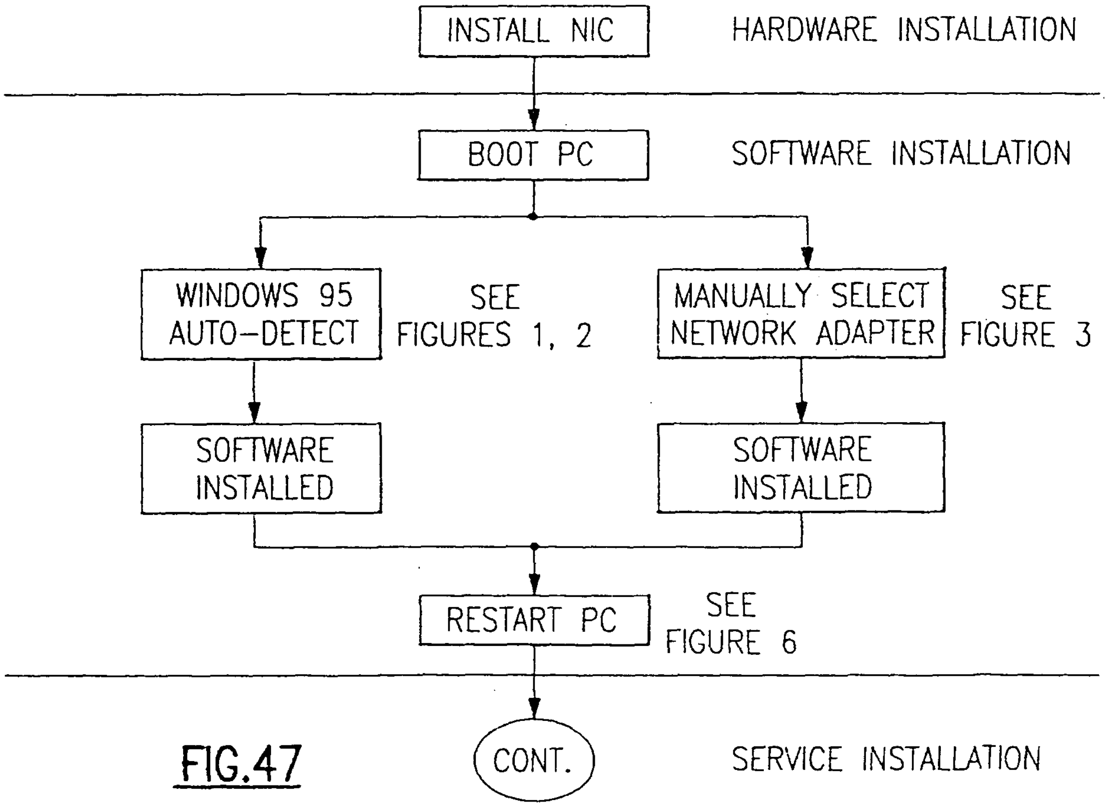

INSTALL NIC
HARDWARE INSTALLATION
BOOT PC
SOFTWARE INSTALLATION
WINDOWS 95 AUTO-DETECT
SEE FIGURES 1, 2
MANUALLY SELECT NETWORK ADAPTER
SEE FIGURE 3
SOFTWARE INSTALLED
SOFTWARE INSTALLED
RESTART PC
SEE FIGURE 6
CONT.
SERVICE INSTALLATION

FIG.47

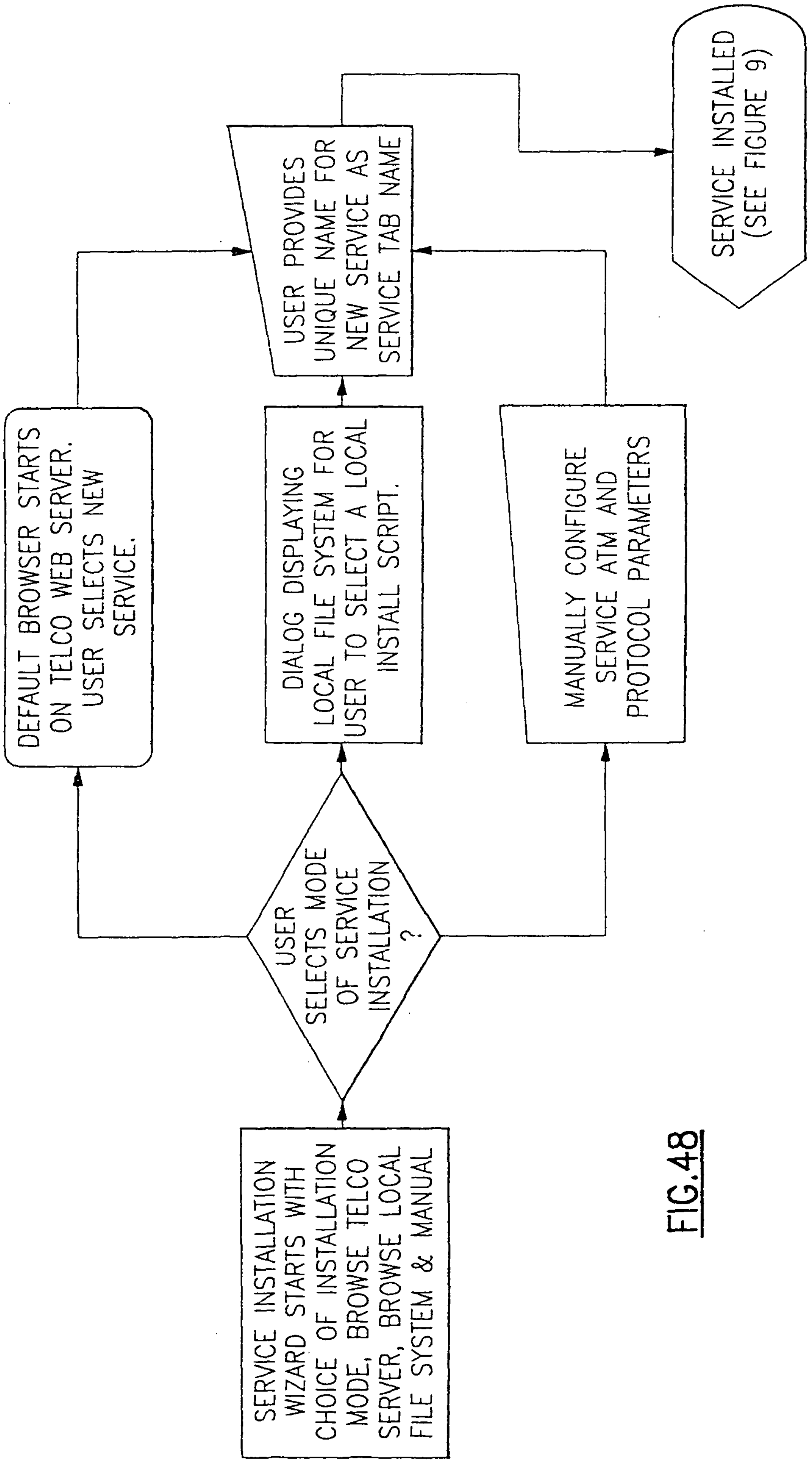

SERVICE INSTALLATION WIZARD STARTS WITH CHOICE OF INSTALLATION MODE, BROWSE TELCO SERVER, BROWSE LOCAL FILE SYSTEM & MANUAL
USER SELECTS MODE OF SERVICE INSTALLATION ?
DEFAULT BROWSER STARTS ON TELCO WEB SERVER. USER SELECTS NEW SERVICE.
DIALOG DISPLAYING LOCAL FILE SYSTEM FOR USER TO SELECT A LOCAL INSTALL SCRIPT.
MANUALLY CONFIGURE SERVICE ATM AND PROTOCOL PARAMETERS
USER PROVIDES UNIQUE NAME FOR NEW SERVICE AS SERVICE TAB NAME
SERVICE INSTALLED (SEE FIGURE 9)

FIG.48

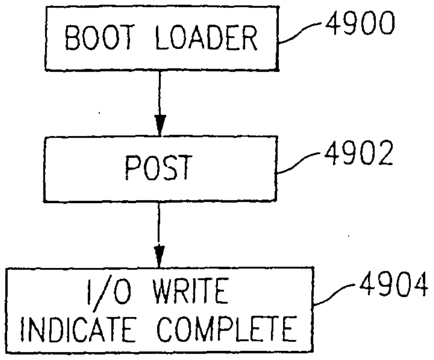


FIG.49

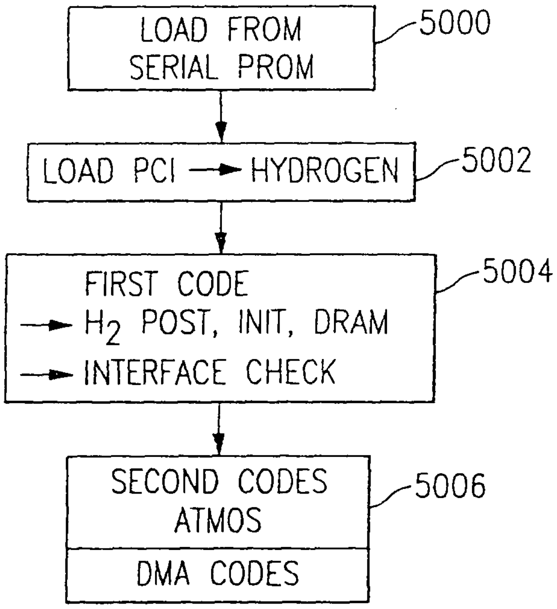


FIG.50

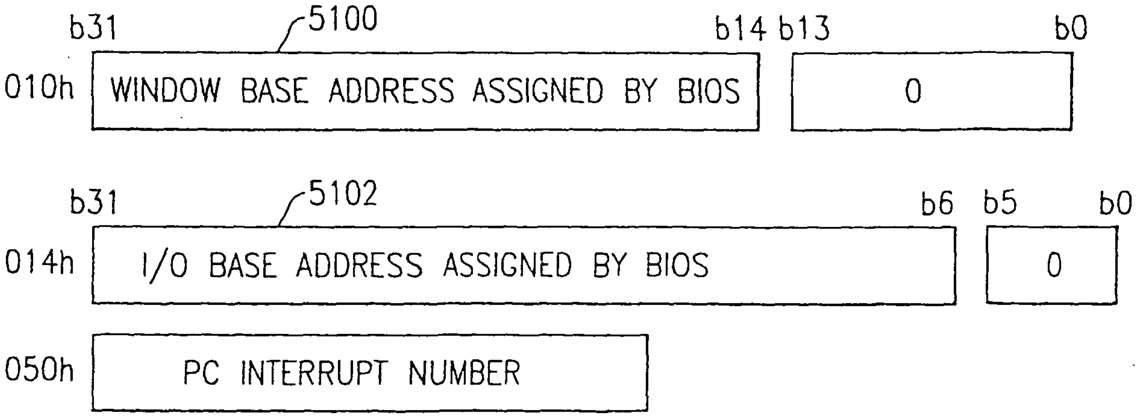

b31
5100
b14 b13
b0
010h
WINDOW BASE ADDRESS ASSIGNED BY BIOS
0
b31
5102
b6
b5
b0
014h
I/O BASE ADDRESS ASSIGNED BY BIOS
0
050h
PC INTERRUPT NUMBER

FIG.51

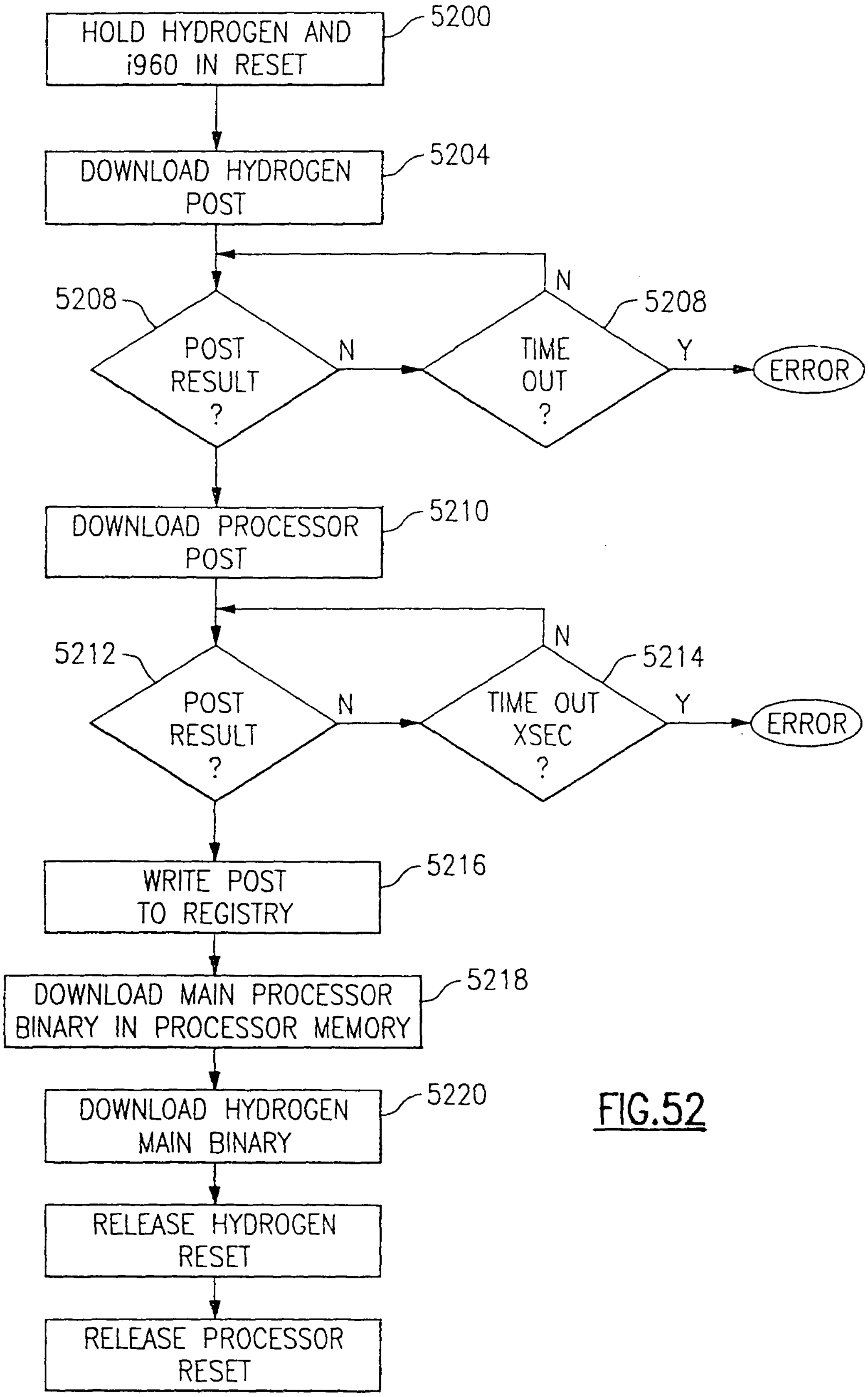

HOLD HYDROGEN AND i960 IN RESET
5200
DOWNLOAD HYDROGEN POST
5204
5208
POST RESULT ?
N
TIME OUT ?
N
5208
Y
ERROR
DOWNLOAD PROCESSOR POST
5210
5212
POST RESULT ?
N
TIME OUT XSEC ?
N
5214
Y
ERROR
WRITE POST TO REGISTRY
5216
DOWNLOAD MAIN PROCESSOR BINARY IN PROCESSOR MEMORY
5218
DOWNLOAD HYDROGEN MAIN BINARY
5220
RELEASE HYDROGEN RESET
RELEASE PROCESSOR RESET

FIG.52

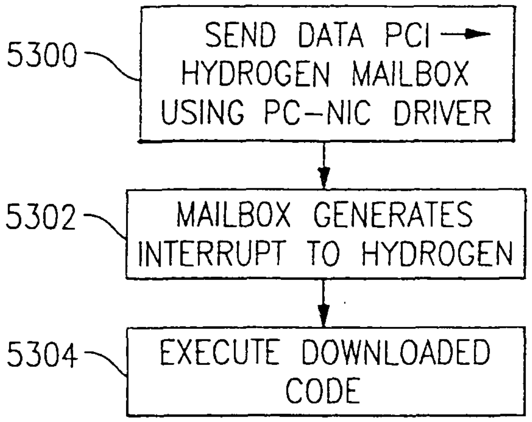

5300
SEND DATA PCI → HYDROGEN MAILBOX USING PC-NIC DRIVER
5302
MAILBOX GENERATES INTERRUPT TO HYDROGEN
5304
EXECUTE DOWNLOADED CODE

FIG.53

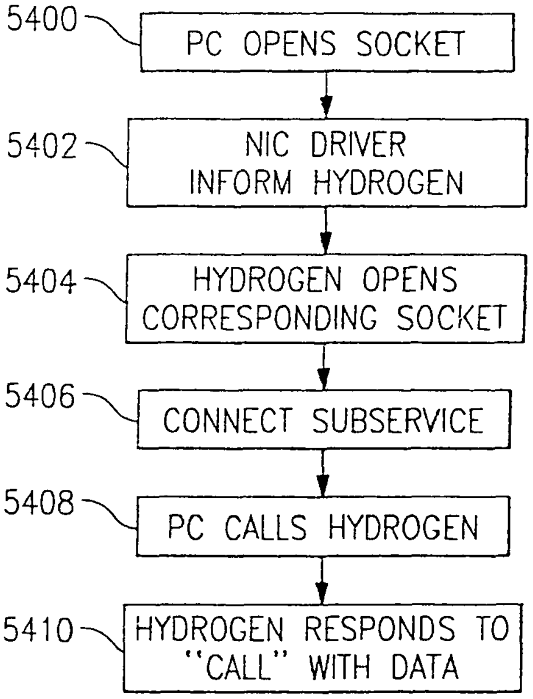

5400
PC OPENS SOCKET
5402
NIC DRIVER INFORM HYDROGEN
5404
HYDROGEN OPENS CORRESPONDING SOCKET
5406
CONNECT SUBSERVICE
5408
PC CALLS HYDROGEN
5410
HYDROGEN RESPONDS TO "CALL" WITH DATA

FIG.54

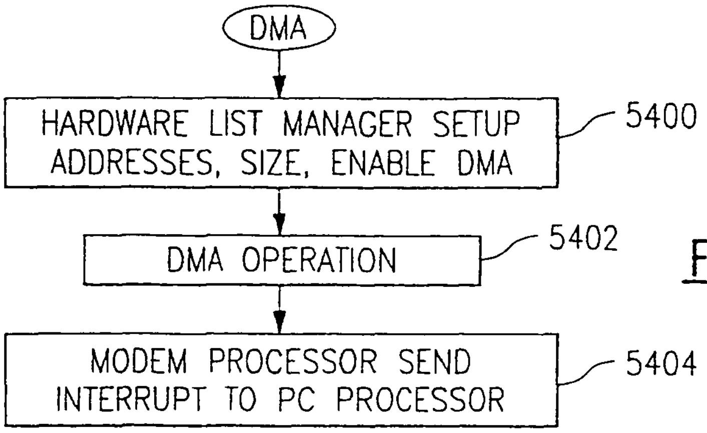

DMA
HARDWARE LIST MANAGER SETUP ADDRESSES, SIZE, ENABLE DMA
5400
DMA OPERATION
5402
MODEM PROCESSOR SEND INTERRUPT TO PC PROCESSOR
5404

FIG.55